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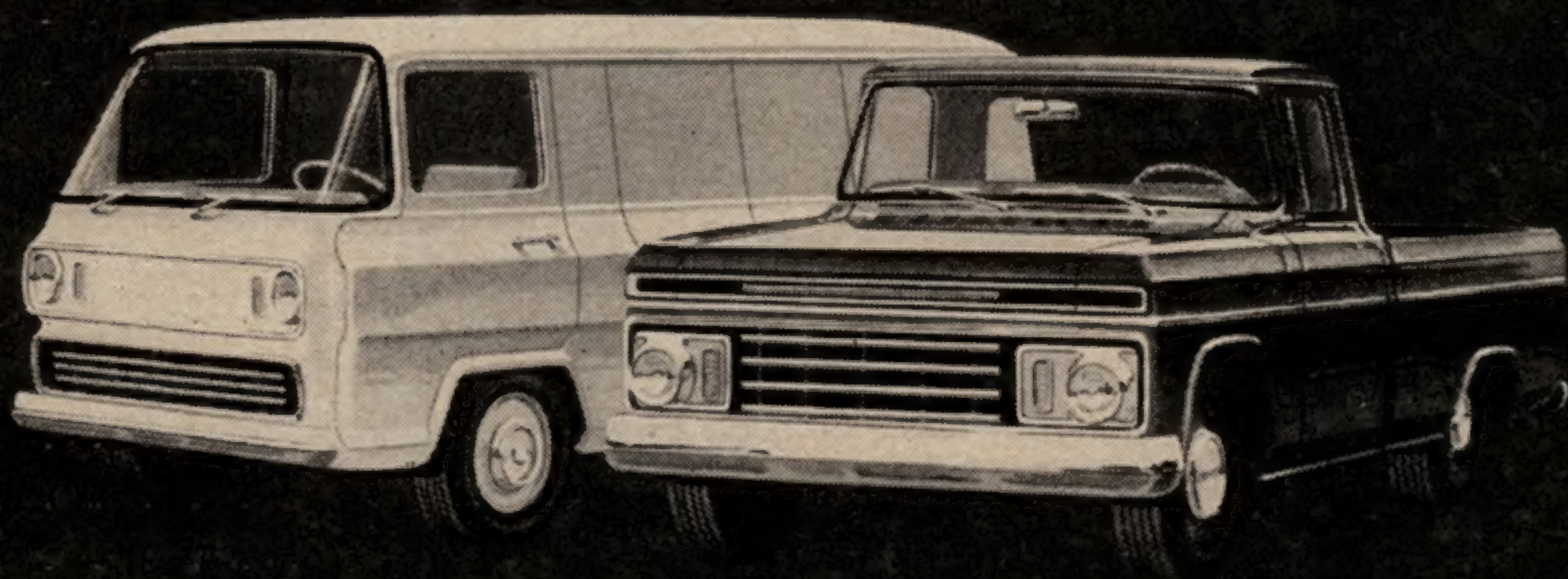
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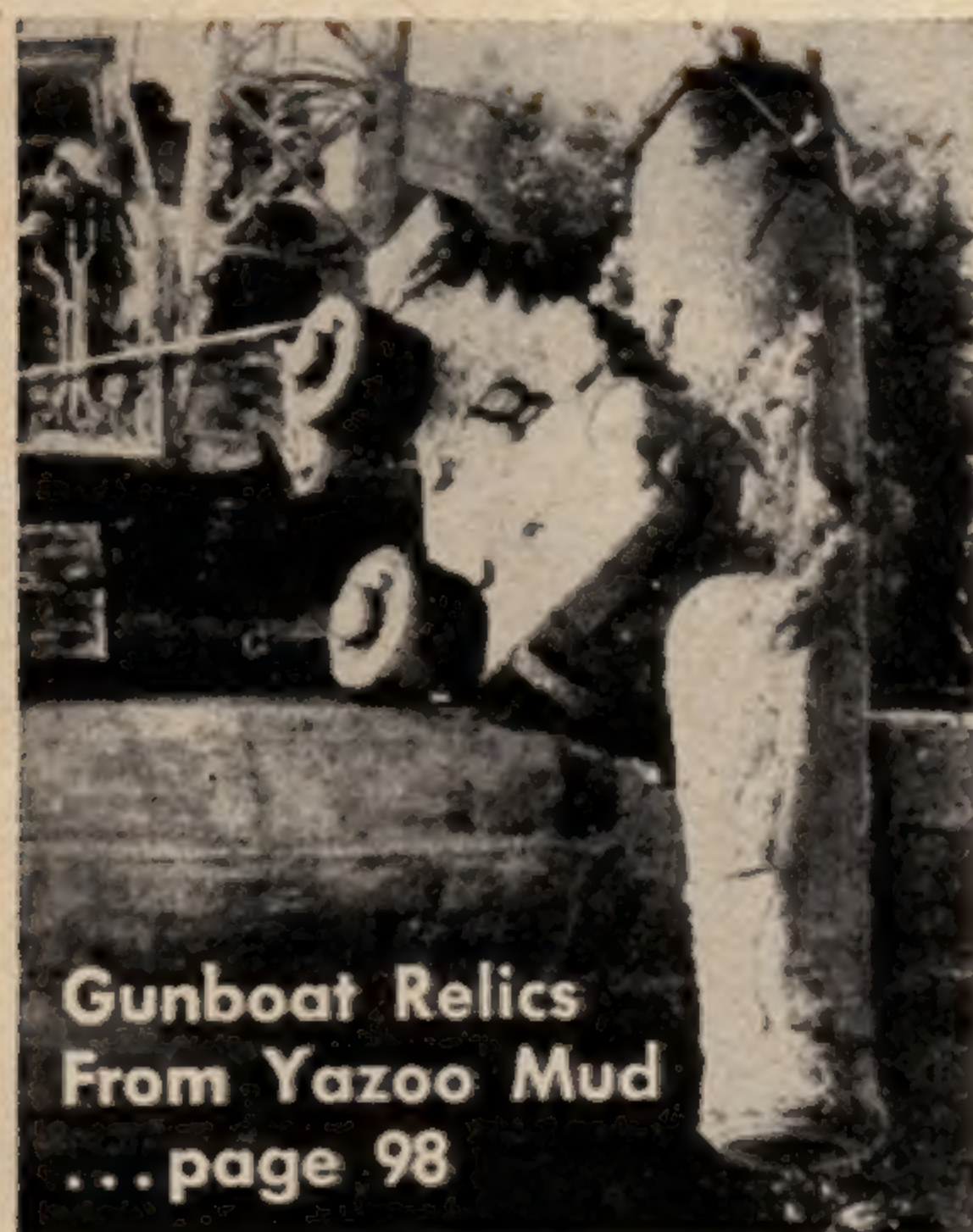
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INTERNATIONAL EDITIONS • AUSTRALIAN • SPANISH • CARIBBEAN • FRENCH • DUTCH

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NEXT MONTH: Sneak preview of the '66 cars, plus an inside look at many detail features you'll find on the new rolling stock. July PM also tells how to have fun at a summer carnival without being "taken." There's a rundown on a new sport—dry land sailing; a buyers' guide to ladders; and handsome fences you can build

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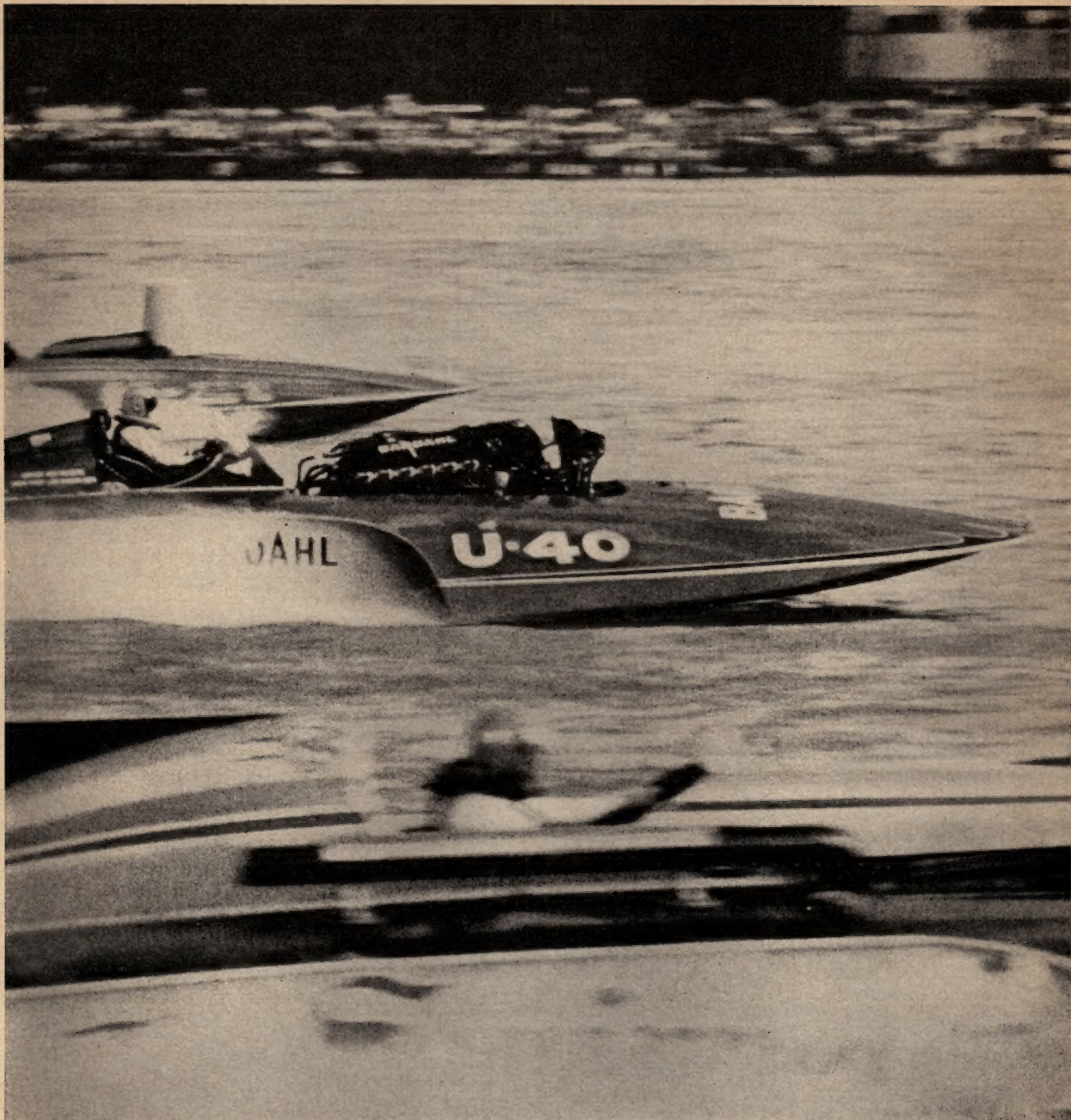
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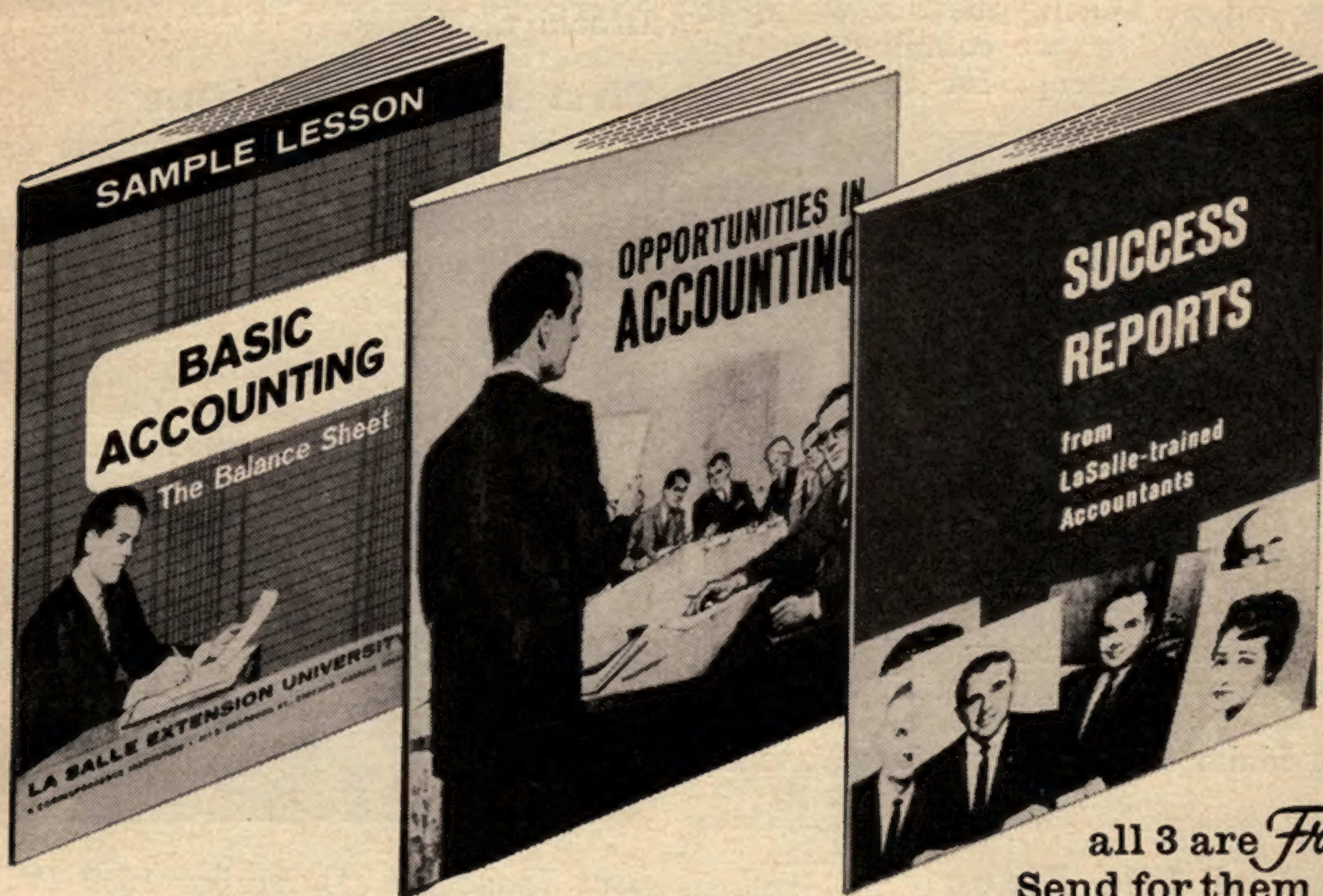
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Over the Editor's Desk

Shingle Builders

We built the *Saucy Shingle* (page 144, March PM), and found the plans quite easy to follow. During the six weeks it took us to build it, we complied strictly with the plans, except for the steering



hookup which is wholly inside the boat.

We used a bright red finish with a black stripe down the middle.

Our marine speedometer shows that we hit a little over 20 mph with a 7½-hp motor.

Parma, Idaho DAVE SHUFF, JON WATSON,
STEVE ZIMMERMAN

Friend of File Flags

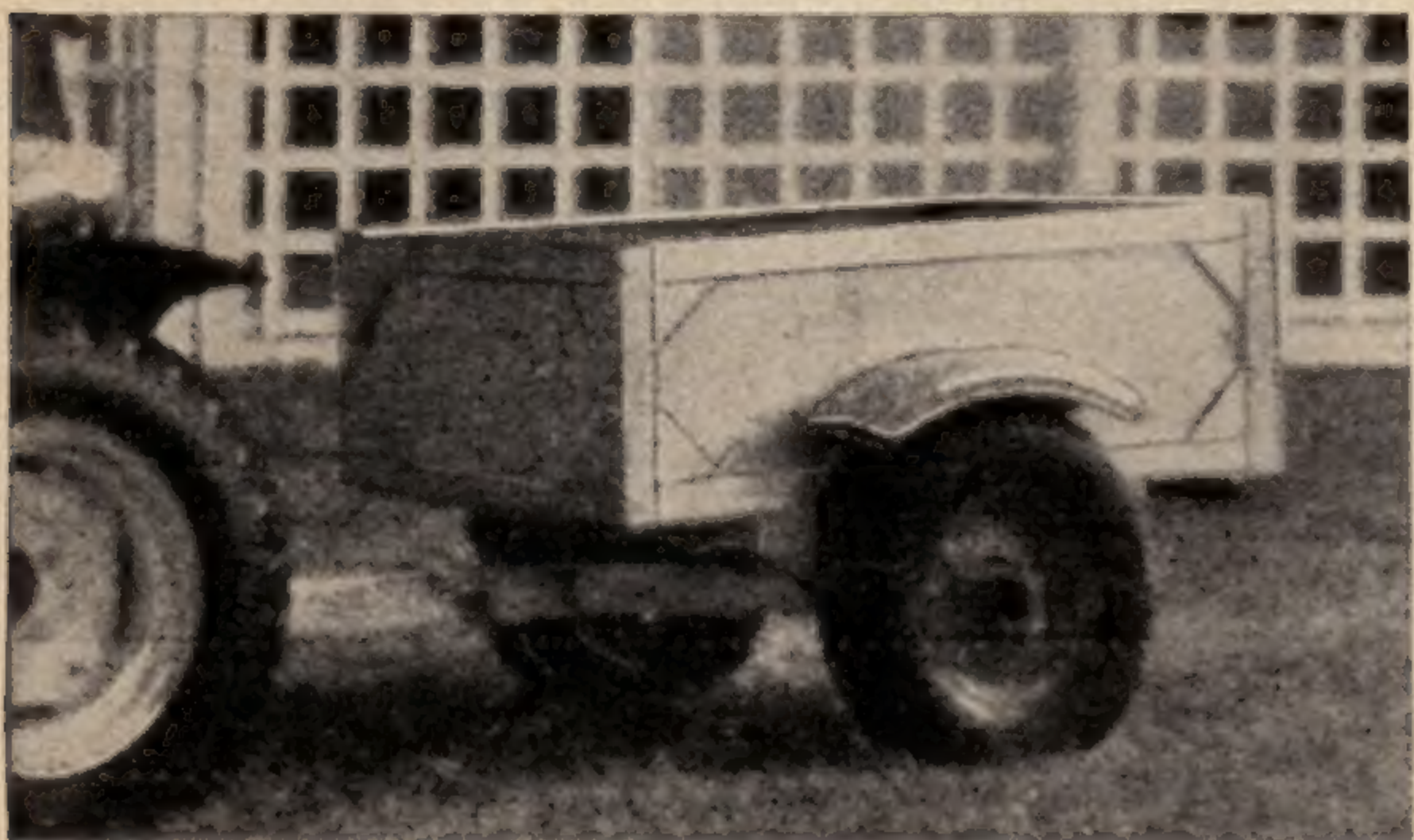
Your new File Flag system (page 137, April PM) is wonderful. Why didn't you start sooner? I have PMs back to 1950.

Newark, Ohio GEORGE W. CRISS

Easy Instructions

I'm thankful for those clear, easy-to-follow instructions for a trailer in *Trailer for Yard Tracs* (page 156, May 1963 PM).

I had bought a garden tractor plus several attachments, but thought that the cost



of a trailer was too much for the use I'd get from it. A neighbor found your plans in his magazine files, and I built the trailer complete for \$17.90.

Colonial Heights, Va. ROBERT M. BROOKS

Steamed Up for Steam

The article on steam cars (*Fresh Head of Steam for Cars*, page 110, April PM) set me to wondering if we aren't ignoring a ready market for a small, silent, odorless source of power for lawn mowers and the like. Imagine your neighbor mowing his lawn early Saturday morning and not waking you up with the noise and the smell. Send me two—one for the guy on each side of me.

Brooklyn, N.Y.

GEORGE GRAY

First Boat a Big One

I was able to spend last summer enjoying the waters of New York Harbor, the Hudson River and Long Island Sound, thanks to your plans for *The PM House-*



boat (page 160, December 1959 PM). It was my first attempt at building a boat. I'd like to thank you for all the help I've received from PM.

New York, N.Y. EDWARD M. FLANAGAN

Tub Thumpers

Your article on the *Washtub Bass Fiddle* (page 169, February PM) gave specifications that appear to have been taken from the booklet that comes with our Tub-O-Phone kit. The kit has been on the market for some time.

Since our book is copyrighted, I think the least you can do is tell your readers that we supply all the parts for a swell string bass (except the tub and stick) in a neat kit with full assembly directions for \$2.95.

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The Editors

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Sidelights from the SERVICES

By William R. Kreh

"Auto"-matic washer. A Marine family in South Carolina has found an easy way to wash clothes during long outings in their Volkswagen Camper. A metal picnic chest is strapped on the front end of their VW, filled with dirty clothes, soap and hot water, and road action cleans the clothes as they travel.

A note on nurses' underwear crept into a speech recently by an Army surgeon who was describing the extreme care taken by the Army to avoid operating room explosions caused by static electricity generated in the presence of some explosive anesthetic gases. Since silk generates such static electricity, the surgeon disclosed, "we have to watch carefully the kind of underclothing our nurses wear."

A portable "wind sock" has been developed by the Navy to enable helicopter pilots to make safer and more accurate landings. When 'copters are called upon to land in remote places—which is quite often—biggest headache for the pilot is knowing wind direction and velocity on the ground. So the Navy has designed a small, lightweight flare which, when dropped, produces a dense green smoke that can be seen easily from a 500-ft. altitude at a distance of more than a quarter of a mile.

The flare is built so that, even though its contents burn fiercely to generate its colored haze it does not create a fire hazard.

The same process that makes egg cartons, speaker cones and some types of luggage is now being used to make some Army test cartridge cases that burn up when the charge is ignited. The fully combustible case, which so far has been developed for 105-mm and 90-mm weapons, is less than half the weight of a metal case of comparable size and has been found to be cheaper to manufacture.

A perfect job for a woman, but it went to a man. Basil Lavitol of the Army's Picatinny Arsenal in New Jersey will begin talking soon and he won't stop, figuratively speaking, for three months. He's conducting an experimental workshop on the voice and how training may improve oral communications.

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Newest thing in shirtwear: a drip-dry undershirt that its maker, a British firm, says is capable of stopping a .45-cal. bullet. The garment weighs only 16 pounds, about half as much as the old-fashioned bullet-proof vest, and costs from \$170 to \$280, depending on size.

Secret of the shirt's ability to shed lead is the unique blend of materials in the fabric: nylon and titanium.

Titanium is a metal that combines great strength with lightness. A lot of it went into the structure of our fastest fighter, the F-12, enabling it to withstand the searing temperatures of Mach-3 flight. More about this exotic metal appeared in *The Taming of Titanium*, page 64, Aug. '64 PM.

The hot-air balloon, man's most primitive aircraft, is the latest innovation in commercial fishing. The Department of the Interior's Bureau of Commercial Fisheries is experimenting with a dacron bag that is 52 feet in diameter and is "fired" with a propane burner. Tethered to a fishing boat, the balloon floats at an altitude of 500 feet, permitting the observer to spot schools of fish as far away as 30 miles.

The magnetic North Pole, say Canadian scientists, has moved 20 miles farther north and about four miles east in the past two years. The new position is at the southern end of Bathurst Island, about 1800 miles north of Winnipeg, Man.

The new "soft" detergents will be on the market this June, according to soap industry officials. With a simpler chemical structure than the old "hard" detergents, they are more easily broken down by bacteria—a characteristic that, it's hoped, will rid our streams, rivers and drinking water of detergent foam.

But oxygen is required for the bacteria to do their work. And oxygen is in short supply in the underground water sources that supply some areas. Such an area is pancake-flat Long Island (N.Y.), where soft detergents have been under test for some time.

"They will not degrade significantly more than ABS, the present (old) type of detergent," a county water engineer told PM. "That's because of the groundwater environment of Long Island."

Working to produce a better re-entry vehicle, space scientists at General Electric have come up with a process that shows great promise in consumer applications. It can put any color permanently onto aluminum (for boat skins and car bodies that won't chip or fade); it can give cooking pots a hard, black coating on the bottom to increase heat absorption, and coat the inside of frying pans with non-stick materials to permanently eliminate the need for grease. The nature of the process is a trade secret.

It's a pear-shaped world. Johns Hopkins scientists, working with the Navy satellite program, have learned more about the physical shape of the earth in the past three years than man previously had learned in the last 200 years.

It's been determined that the southern hemisphere is larger than the northern and that the surface of the oceans is not level. Water in the harbor at Dublin, Ireland, is 150 yards higher than at Charleston, S.C.

Stick around—in another 100 centuries you might be able to homestead on the Antarctic continent. Geologists believe it's slipping out of its ice age. Shackleton Glacier, long under study, has been found to be 1100 feet thinner than it once was and slowed up in its flow. Dr. F. Alton Wade, an expert on the Antarctic, has predicted "farms and forests at the South Pole in about 10,000 years."

Launchable, precast concrete lighthouses have been developed in Sweden. To start with, the structure is in the form of two tubes, one inside the other. With both ends plugged, the big tube is towed into place, upended, sunk and anchored with sand. Then water is pumped in, causing the inner section—the actual lighthouse—to rise into position.

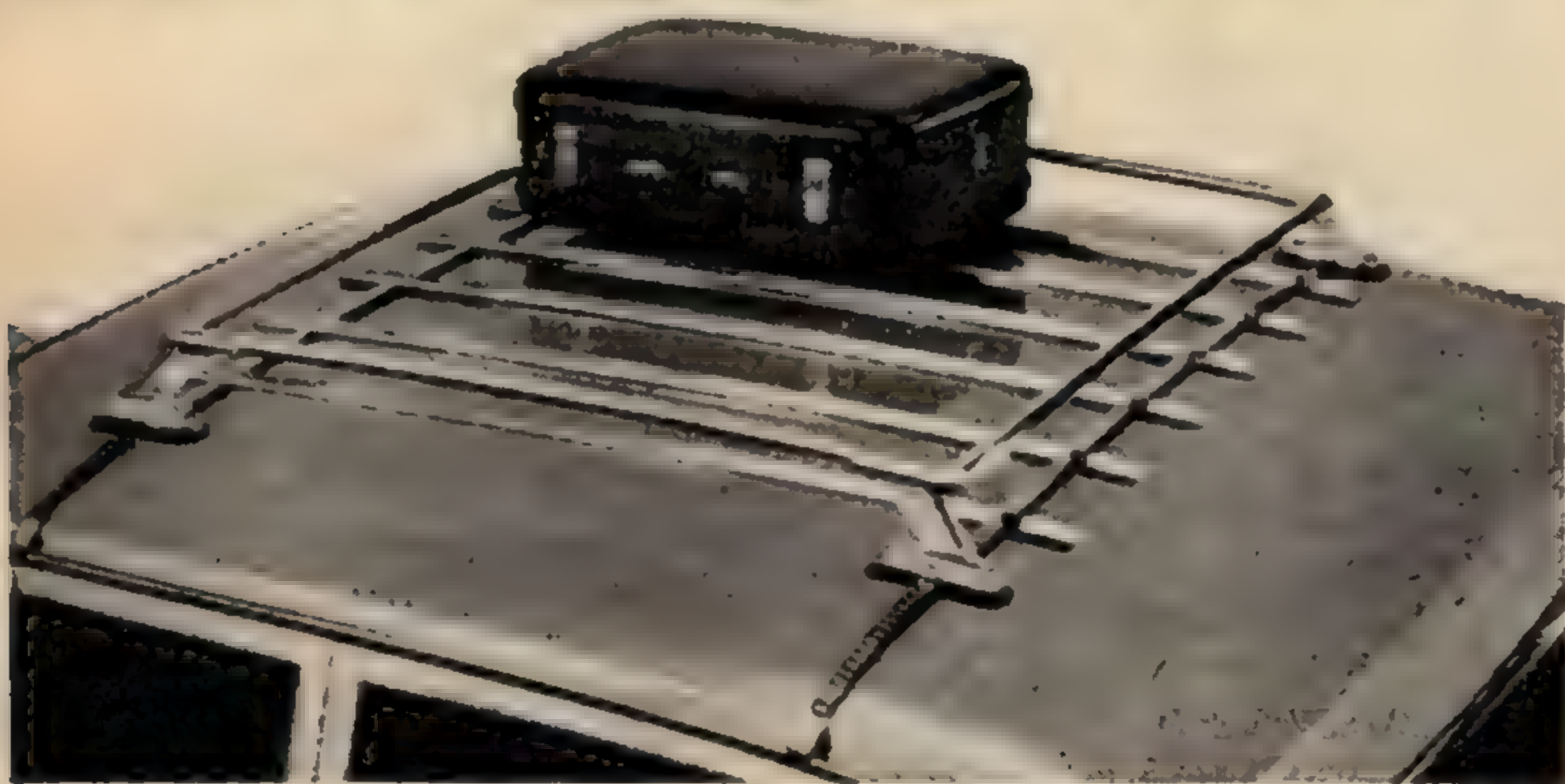
Firefly glow—or at least a copy of it—will soon be put to use to detect signs of life in the high atmosphere. It will provide a test for a phosphate called ATP that occurs in all earthly living matter. On a lazy summer's evening the firefly adds three other chemicals to ATP and, presto, light!

The Goddard Space Center has developed a little apparatus that will supply

(Please turn to page 14)

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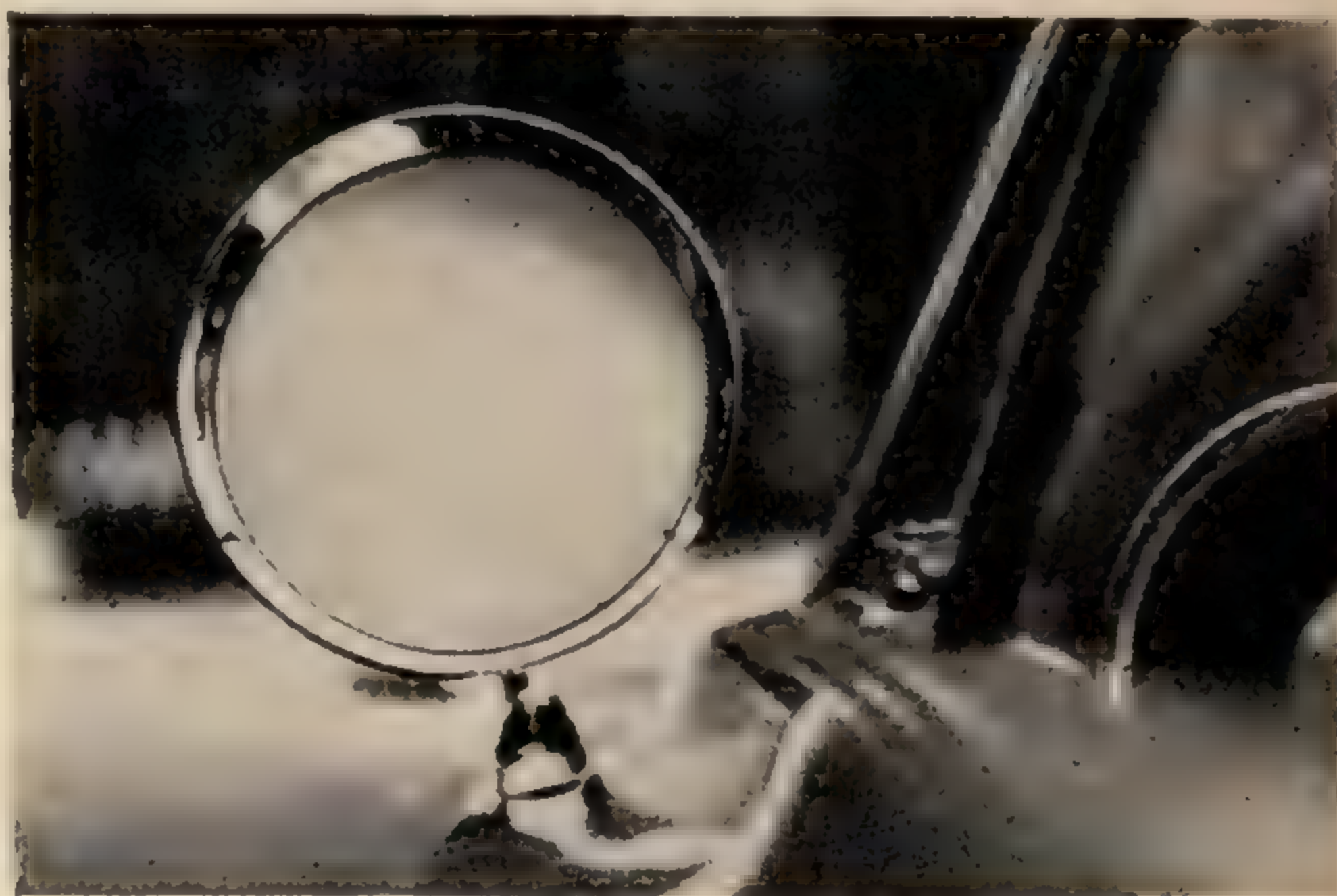
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Science Worldwide

(Continued from page 12)

the three chemicals. Rockets will carry the apparatus to great altitudes. If it encounters ATP and glows, the investigators will know that some form of life—bacteria, spores or other organisms—exist that high up.



Down the rivers and into the seas go pesticides, perhaps to become concentrated there like salt and other minerals. A recent study of seabird eggs on the coast of England shows how these chemicals persist. Every egg contained easily detectable amounts of insecticide, which had gone from water and dead insects to fish, from fish to birds, from birds to eggs.

Minute amounts of the chemicals (organochlorines) have been found in penguins and seals of the Antarctic. An international oceanographic group calls the outlook "terrifying" if the chemicals continue to go down to the sea.



The gegenschein is being investigated. It's a faint glow 20 times larger than the moon that appears every midnight directly overhead. NASA scientists believe it could be made up of small fragments left behind by comets.

There are five traps around the earth that can capture and hold smaller bodies in a fixed area. They are formed at points where the gravitational fields of the earth and sun meet.

The gegenschein (German for "behind the sun's shine") would be, the theory goes, comet particles caught in one of the traps and lighted by the sun when it's high noon on the opposite side of the world. It's located about a million miles out in space, scientists estimate.



The laser beam, one of science's latest glamour items, may hold hidden dangers for man as it becomes a more widely used tool in industry and medicine. So say scientists doing Army research.

They report that damage to the eyes, brain and other organs may not be immediately apparent. In one lab test, they focused a laser beam on the foreheads of mice. Though exterior damage was only superficial, damage inside the skull was extensive and frequently fatal. In other experiments, laser radiation caused animal tissues to react in a manner that has been linked with the cancer process.

John F. Pearson
Science Editor

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Sidelights on AVIATION

Several readers questioned the claim in the April *Sidelights on Aviation* that the Convair XC-99 was the world's largest airplane, suggesting that the Hughes *Flying Boat* or the Douglas XB-19 were larger.



DOUGLAS XB-19 was not world's largest land plane

We have to say yes on the first and no on the second, but hasten to add that we said the XC-99 was the largest *land-based* aircraft. The Hughes monster, while larger, was a seaplane and, in fact, made only one flight—straight ahead for one mile at a maximum altitude of 70 feet. Some question whether it qualified for *any* record.

The Douglas XB-19, while large in its



HUGHES FLYING BOAT was world's largest seaplane

day (the early '40s), was smaller than the B-36 on which the even-larger XC-99 was based. These are the dimensions:

	Hughes	XC-99	XB-19
Span	320'	230'	212'
Length	219'	182'	132'
Height	80'	58'	43'
Weight	200 tons	66 tons	42 tons

That settle it?

Kevin V. Brown
Aviation Editor



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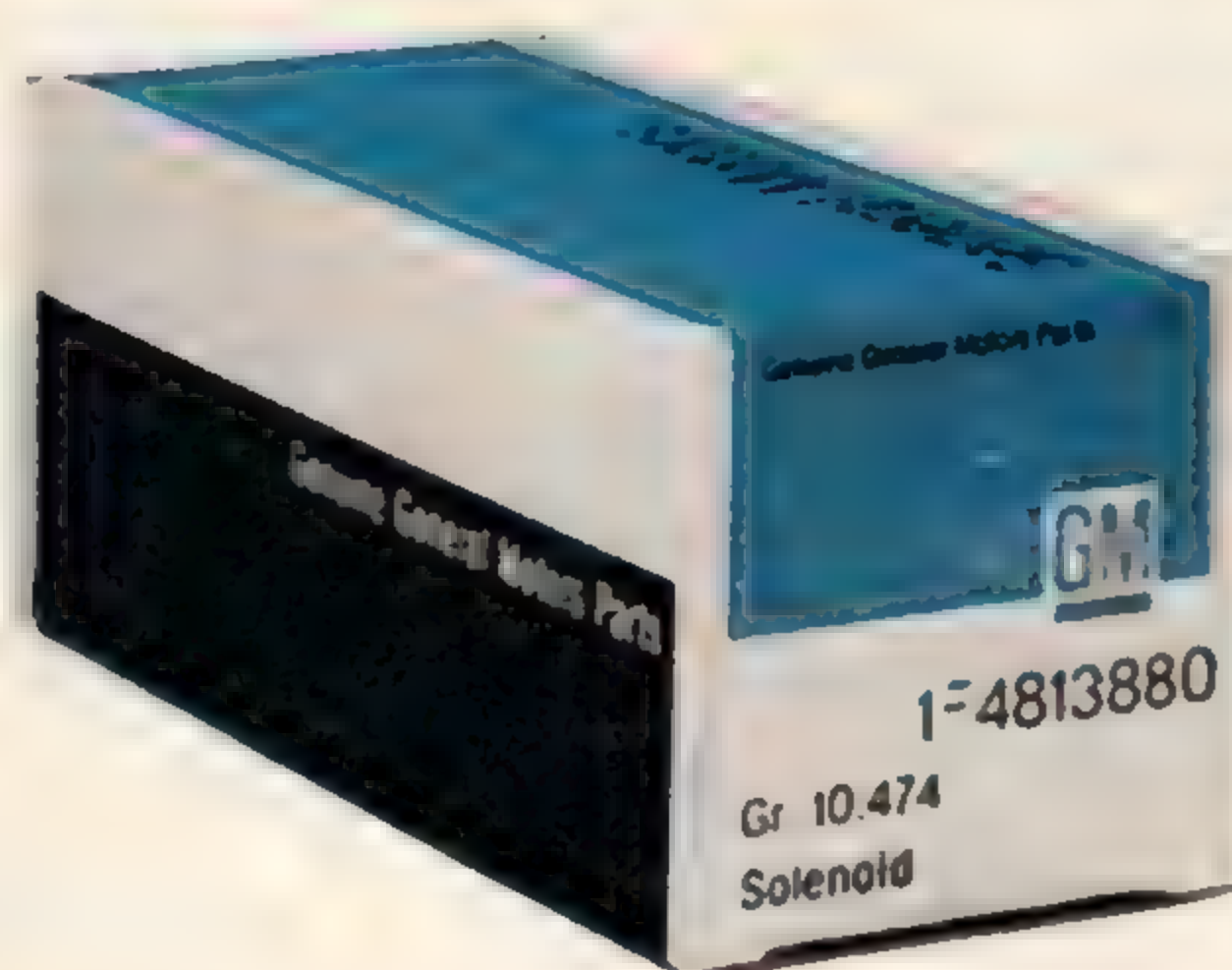
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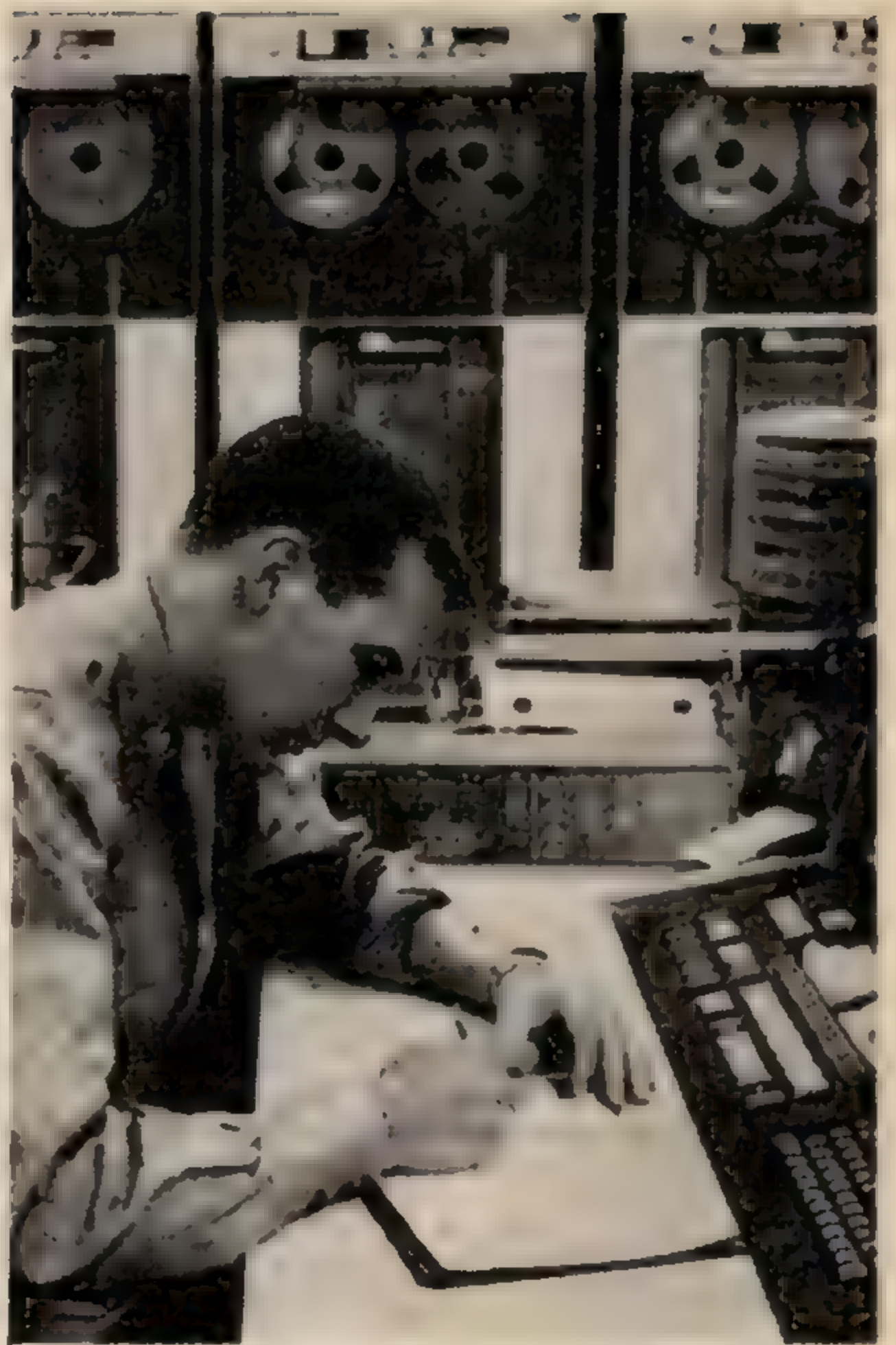
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Army

Take Charge of Your **CAREER**

By Richard Dunlop

SUMMER JOBS for high school and college youths are as much a part of the vacation months as backyard barbecues and mowing the lawn. A national survey indicates that almost half of the boys of high school age (14 through 17) work at some time during the year; most of these find employment in the summer.

This is still so, even though automation has done away with some jobs which until recent years were filled by youth, and many employers hesitate to add temporary help to their force because of the costs involved. They prefer to stagger their permanent employees' vacations instead.

Look for Opportunities

Next year you would be wise to get your application in for a summer job before the middle of March, but there still are opportunities for this year if you will go out and look for them. The trick is to figure out what industries naturally expand in summer months and apply there. Soft-drink bottlers, ice cream and dairy companies, hotels and restaurants all do a bigger business in the summer; they are likely to need extra help. Less obvious are companies which go into fevered production in the summer to meet Christmas demands for toys and other merchandise.

Across the nation state employment services are filling orders for youth to work for a few weeks or months as typists, stenographers and in shipping rooms. Register with your state employment service, but also tell your friends and neighbors that you want a summer job.

Sometimes a temporary work service can give you steady employment for a summer by placing you in first one office or plant and then another. For example, Manpower, Inc., has offices in 350 cities in 42 states and overseas. Teens can work in several cities in one summer if they qualify. Duties range from filing to secretarial work, sales and office machine operation. If you cannot find a Manpower office in your phone book, write to the national office at 820 N. Plankinton Ave., Milwaukee, Wis. 53203.

Don't Forget Camps and Farms

Amusement parks, summer theaters and

summer resorts all take on employees for the summer. So do the parks and playgrounds in your own home town. Summer camps for children need youth as counselors. The 10,000 members of the American Camping Assn. do much of their hiring through state employment offices.

State employment services can also let you know what jobs there are in your area on farms. This year there will be fewer migratory workers available, and teen-agers will be in increased demand in the Northwest, California and the Midwest. High school boys who work in California beet fields are called "beetniks"; they enjoy plenty of farm food, fresh air and sunshine, as well as earn a tidy sum toward their school expenses in the fall.

Glamour jobs in national parks and monuments are mainly taken up for this summer, but guides, cooks and waitresses are hired for the season by hotels, lodges and trading posts operated by park concessions. Write to National Park Service, U.S. Department of the Interior, Washington, D. C. 20240 for a free brochure, "Seasonal Employment in the National Park Service." Pick your park and get in your application as soon after next Jan. 1 as you can in order to get a park job for 1966.

Back to School in Fall

Regardless of how good a job you get for the summer, go back to school in the fall. This is the advice of all the experts on employment and careers. Next year 3.7 million boys and girls will turn 18—the largest number in the country's history—and economists say that they will make the nation hum.

"The teen-agers coming along now will have more education than their predecessors," says Arno H. Johnson, economist with J. Walter Thompson Co., the advertising agency, "and consequently will be in a better position to meet the rising requirements of employers."

As recently as 1950 only 68 percent of 17-year-old youths were still in school, but today 80 percent of youth of this age are in the classroom. A boy who drops out of high school is bucking an overwhelming tide.

Former Dropout Aims for Ph.D. Degree

Jim Carmichel of Johnson City, Tenn., dropped out of high school. He found a job paying \$35 a week and got married. Just as his wife had a baby, he lost his job. He decided to go back to school. Fortunately he was able to borrow money to pay his tuition at a famous southern school specializing in heavy equipment operation, where he enrolled in the bulldozer and

(Please turn to page 21)

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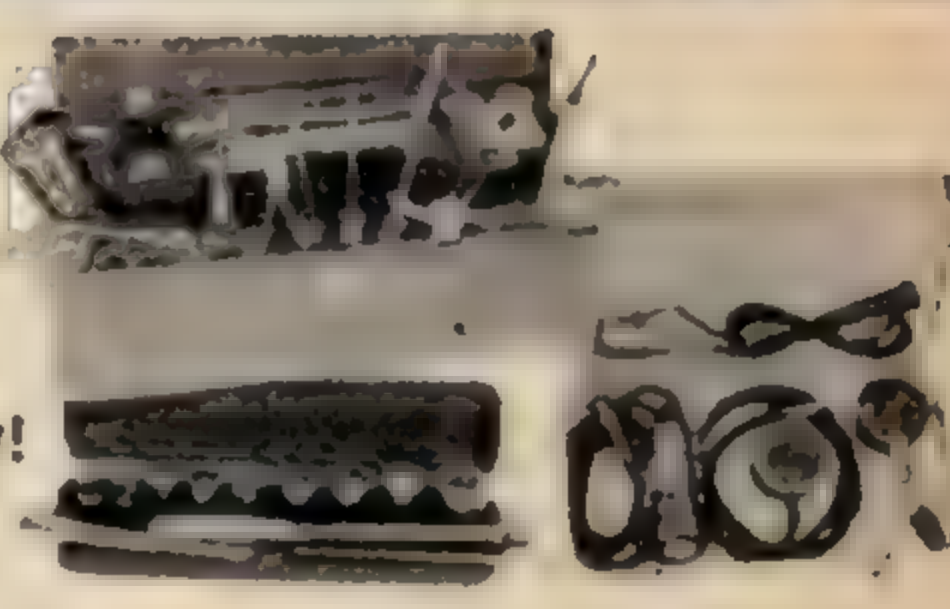
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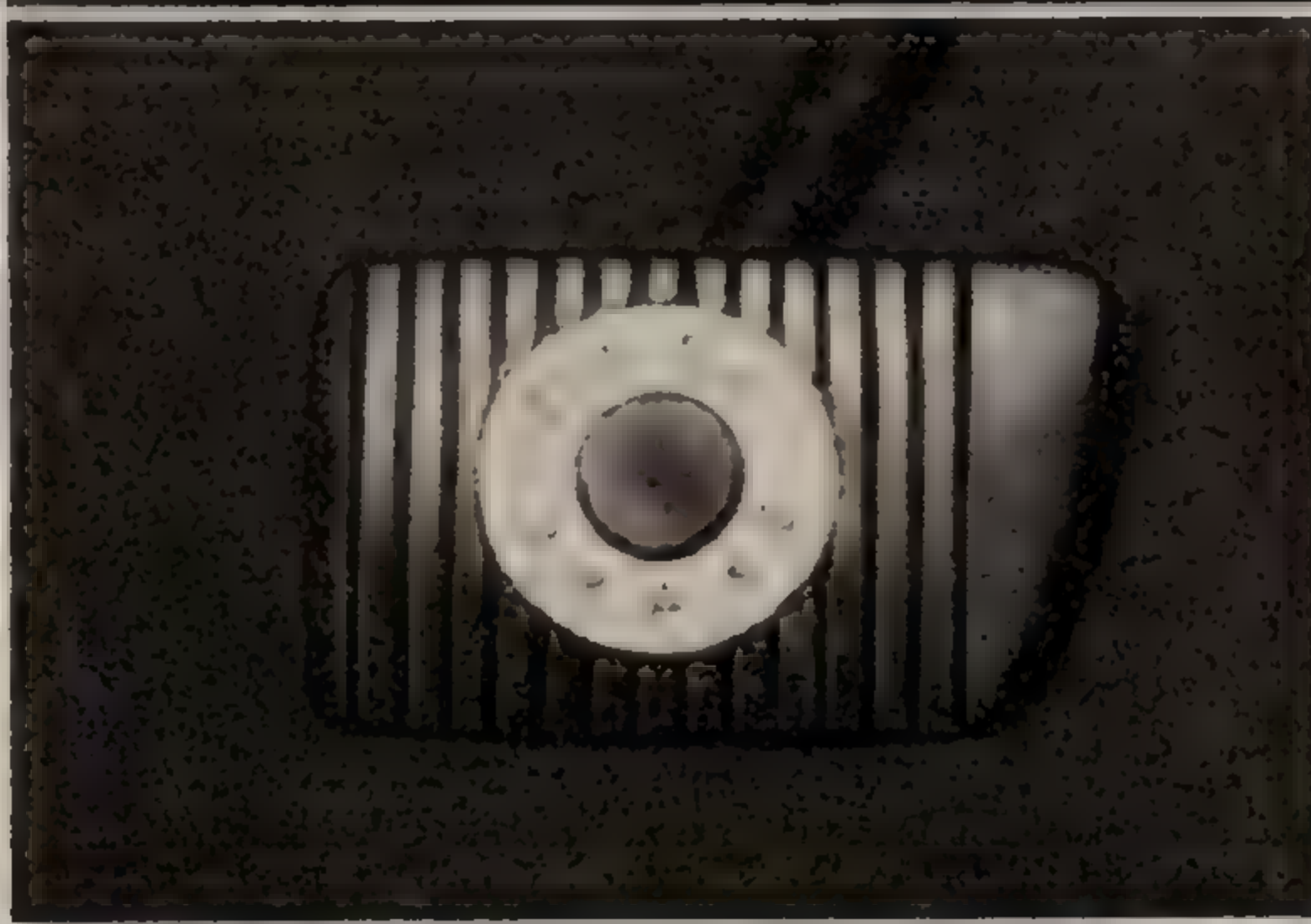
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Take Charge of Your Career

(Continued from page 18)

scraper course. He finished his training in 1959. He got his first job running a D-9 pushcat and paid off his debts.

"Next I took a job on a rush airport job jockeying a Euclid pan," he writes. "Pay: \$250 per week, \$13,000 per year. Less than a year before I had been making considerably less than I now paid in taxes.

"With my build-up of funds I recognized the possibility of bettering my lot once more. Why not go to college? If and when the money ran out I could quickly get another construction job and build up another stake. Of course, getting into college wasn't easy. I was a high school dropout. Remember? They threw every kind of test at me they could find. I wasn't smart, but I held out. Learning a trade had given me the kind of confidence I needed."

Jim studied so diligently that he became a graduate assistant in the English department. He joined the varsity rifle team. "At present," he reports, "I'm with the English and speech departments of East Tennessee State University. And I also continue my love of guns by writing a weekly column for the local paper. Soon I'll start work on my Ph.D. degree. Impressed?"

We are impressed, and this is quite a story for a high school dropout. Jim's example is proof that when a boy finds out how bleak his job future is without a high school diploma and goes back to school, he often makes up for lost time.

Offer Home Study in Photo Phonics

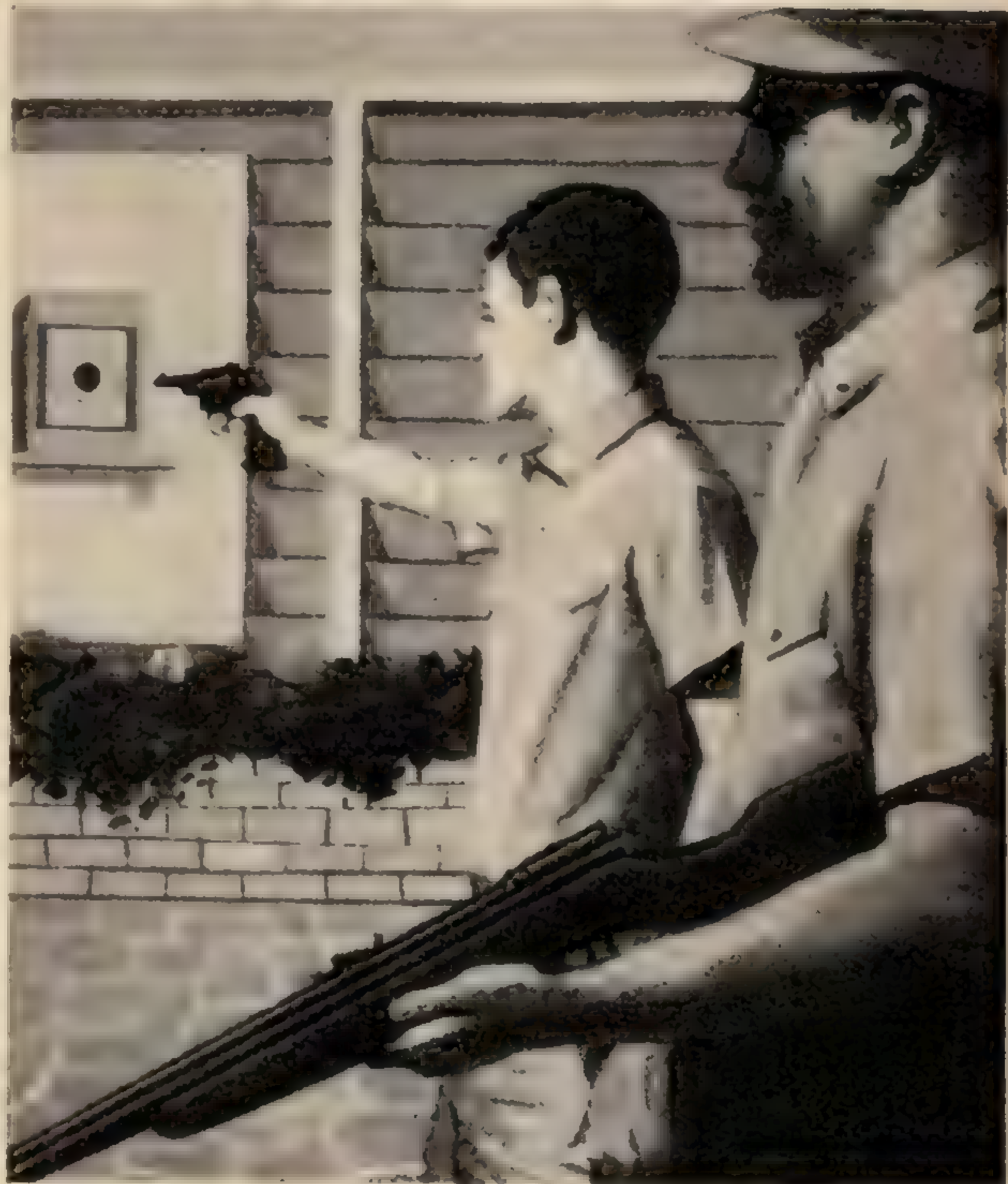
Not only photographers but teachers, doctors, sales managers, training directors and youth leaders are invited to take new home study courses in photo phonics offered by at least one camera school.

"Just like ham and eggs, photography and sound go together," is the claim advanced by a Colorado school pioneering in this field.

For most professional and amateur photographers, combining pictures with the output of a tape recorder is a puzzler. Instruction in the new correspondence course covers the preparation of slide, filmstrip or motion picture shows with sound and includes planning, script writing, photography, sound recording, editing and projecting for an audience. Each student is expected to prepare a sound show of his own.

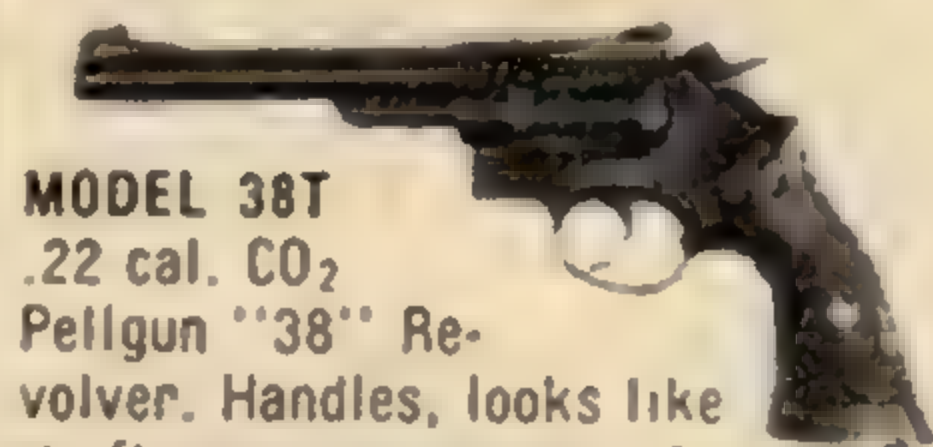
We hope that this course will not only qualify many readers for better jobs, but will result in a higher level of the home movies and slide shows that we are invited to see.

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why not
a range in the home?**

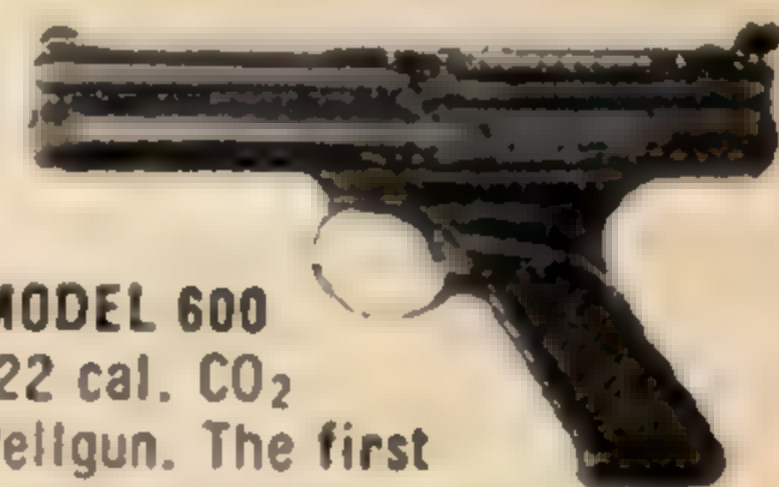


A Crosman Pellgun® Range!

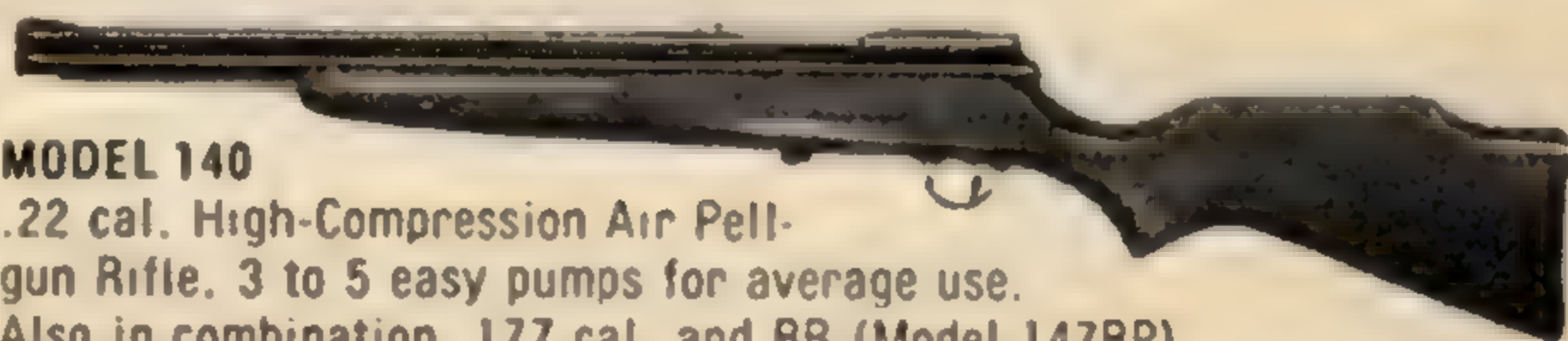
All you need is a target. A simple backstop. A Crosman Pellgun or BB gun... pistol or rifle... that looks, feels, shoots like a real firearm. Set up your range anywhere. Patio, backyard, cellar, family room. Ammunition cost? Pennies! So practice. Compete. Have fun... with a Crosman CO₂ or air-powered fun-gun. No kick, no flash, no big bang! *Controlled range and power.* Priced from \$14.75*. Choose from six rifles, seven pistols. Have your own four-season range in the home!



MODEL 38T
.22 cal. CO₂
Pellgun "38" Re-
volver. Handles, looks like
its firearm counterpart. 6-
shot target model shown, 6" barrel.
Also Combat model, 3½" barrel.
Either model \$27.50*.



MODEL 600
.22 cal. CO₂
Pellgun. The first
semi-automatic pellet
pistol. Can fire all 10 shots
in 3 seconds! \$27.50*.



MODEL 140
.22 cal. High-Compression Air Pell-
gun Rifle. 3 to 5 easy pumps for average use.
Also in combination .177 cal. and BB (Model 147BP)
Either model ... \$27.50*.

*Suggested U.S. Retail Price

FREE BOOKLET "Shooting Fun" describes all Crosman pistols and rifles. At Dealers or write Dept. PM065.

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Crosman Arms (Canada) Ltd., Dunnville, Ont.



DETROIT LISTENING POST



By Ed Nelson



Rambler Nearly Lost the Mobil Run—in Detroit. More on Front Drives and Merc's 'Mustang'

Sniffing around at the Mobil Run: To help rid Rambler of its granny image, American Motors actually considered telling its Mobil driver to lose. "Let Falcon win," was the idea. "They can have the no-fun, minister's-car stigma." But they decided to win and let the Marlin change the image. It's succeeding.

Here's an indication of the importance British car builders attach to the U.S. market: The new **TR4A**, besides independent rear suspension, has a U.S.-style smog breather that feeds crankcase fumes to the intake manifold.

Meanwhile, back at the ranch in Dearborn, **Ford's** positive crankcase ventilation system has been quietly dropped from all but California-bound cars. The PCV valve clogs without careful maintenance, and efforts to spread the word get little attention. Looks as if we're too oriented to a set-it-and-forget-it philosophy.

A crash program is underway for a real solution to smog troubles. Engine modifications—like **Chrysler's** "clean air package"—are in the lead. Like the better brakes and other safety improvements due in '66, this industry-wide campaign comes largely from growing political interest in the automotive field. And, of course, the politicians' interest increases when they decide yours has. So sound off.

Ford Motor Company's front-drive **Falcons** (three are being tested) are far from ready for introduction. Well informed Detroiters doubt that a front-drive from Dearborn will be on a low-cost car like the **Falcon**. Fewer parts mean a manufacturing saving, but service and maintenance get costly when you have to pull the engine and front end for many jobs. Bosses figure that customers for a low-cost car will shy away from a unit that promises high upkeep costs. (We'll be able to tell you more about Ford's front drive tests next month.)

Design of a proper-handling front-drive car is considered something of an accomplishment because wheelbase is so critical. France's **Citroen ID** and **DS** models, for example, were designed front end first.

Then they shifted the rear wheels back and forth until handling was okay, resulting in some rather strange styling.

Engineering circles consider **Olds'** soon-to-be-announced front-drive competitor for the **T-Bird** might strain the abilities of the average motorist because of the changes in handling during a corner. With power on, understeer is strong. The wheel fights to straighten out. But if, part way through the corner, you decide you're going in too hard and come off the throttle, oversteer sets in and the wheel seems to pull sharply into the bend.

Olds ties an automatic transmission to its front-drive package to minimize engine braking so this effect isn't so strong. Radial tires will help, too.

The front-drive car will get practically all the attention from **Olds** and the ad boys are busily boning up on engineering concepts in anticipation of a rash of questions. (I anticipate a rash of claims.) On the other Lansing cars, front and rear sheet metal and trim will be all that's new. The aluminum **Olds** engine you may have seen predicted is very unlikely for '66.

Watch, too, for our story on **Chrysler's** V6 engine, the **Imperial's** new shell, the newly named **Dodge**. (It gets the nameplate from the **Dodge** show car, the **Charger**, and the show car's full-width taillight, but little else.)

Mercury has been touring with its **Cougar** show car, too—and will hang that name on a **Mustang**-type entry with styling of its own. Nothing's official yet, of course, but '66 looks lively.

Maybe the cockpit-filling downpour at Sebring this year was a blessing in disguise. One **Cobra** driver moaned to Ken Miles, "I was in water to my waist. I wanted to get waved to the pits so I could show somebody." Winner Hap Sharp told me at breakfast he drove in water up to his armpits. Over grits Hap's partner, Texan Jim Hall, figured the 300-odd pounds of water helped the huge, Indy-style tires keep in touch with the track instead of aquaplaning.

How **AC** Fire-Ring Spark Plugs clean themselves – help boost engine power



1 As the AC Spark Plug fires, it cleans itself, helps deliver maximum power from each drop of gasoline.



2 During combustion, the intense heat of AC's exclusive Hot Tip Insulator burns away fouling deposits.



3 AC's cleaner tip helps maintain full power longer, helps promote better mileage from your car.



4 AC's self-cleaning action helps boost power and performance. Specify AC Spark Plugs when you change.

AC SPARK PLUG  THE ELECTRONICS DIVISION OF GENERAL MOTORS

CLINIC FOR HOMEOWNERS

Q I've just started modernizing the interior of my home. I want to replace the old wide baseboards with the new type which are only about 3 in. wide. The finish coat of plaster ends just below the old baseboards so when I remove the baseboards about 4 in. of the rough coat will be exposed. I've been told I can't trowel on a finish coat because it can't be feathered out. Breaking up the old plaster and applying a new coat doesn't seem to be a good idea because the old plaster is still in good shape. What can I do?—T.W., Neb.

A Unfortunately, there isn't any simple solution, except possibly wallpapering and carrying the paper down to a point below the top of the new baseboards. Probably you would have to size the exposed brown coat, or rough plaster so that it wouldn't absorb the water in the paste.

But wallpaper in every room may not be desirable. In such a case, about the only other alternative is the use of patching plaster to cover the area exposed by removal of the old baseboards. Spackling could be used instead but it is more expensive. At best, the job is a tedious one. The best procedure is to have a professional break out the old plaster in back of the original baseboards and replaster. He will be able to match the new plaster to the old. Of course, this would increase the cost appreciably.

Q My home, built two years ago, has a slab floor. When the temperature goes below freezing in winter, I notice the floor is damp, especially near the walls. Some of my neighbors living in the same type of home are also bothered with a dampness problem. Others have had no trouble. All the homes in the area are on high ground with good drainage. But moisture comes up just the same. What is the cause and remedy?—H.L., Ark.

A The moisture does not "come up" as you say. It is condensation from the air in the room, not moisture from outside or from under the floor. Because the



What does "torture testing"

STANLEY LEVELS

Torture testing is a must... to assure exceptional accuracy and long service life of levels. Stanley levels are tested in extremely hot and cold temperatures and under severe shock conditions. Here are three reasons why Stanley levels can pass these rigid tests:

(1) A durable truss-constructed body locks accuracy in. (2) A close-tolerance milling operation makes the top and bottom and both ends perfectly parallel for positive accuracy. (3) Solid-set level vials are protected by shock-padded glass covers.

floor is a few degrees cooler than the air in the room, the moisture condenses on the floor. It isn't unusual for similar homes in the same area to vary in this tendency. Generally, it will be found that the air moisture in the home having a dry floor is at a much lower level than in the home with a damp floor. This points out the remedy—reduction of the moisture level. Preparation of food, laundering and bathing—especially showering, releases large quantities of moisture. This can be controlled in many ways. For example, cooking time should be kept to a minimum; allowing the teakettle to simmer continually is a practice to be avoided. It is important also to make certain that your automatic clothes dryer is properly vented so that moisture-laden air can escape. Ventilators in the kitchen and bathroom are an effective weapon in the fight against moisture. In many instances, homeowners have found it helpful to operate an electric dehumidifier a few hours every day. These units are available in various capacities to suit different requirements.

Q My stone-fireplace chimney is decorated with a wrought iron initial. Although I've kept the metal painted, a dark

stain is appearing right below the initial. I suspect the stain is rust. What can be done to remove the stain?—P.N., Ohio

A The stain may be paint pigment, rather than rust. Usually such stains or discolorations will yield to a careful dry scrubbing with a wire brush. It may help to apply a solvent such as lacquer thinner to the area. If paint pigment is the cause of the stain, the solvent should loosen it, making removal quite easy.

Q The yellow plastic tile in my bathroom have become dull and discolored. In addition, some are coming loose. Can I re-cement the loose ones and then paint over all the tile?—C.K., La.

A Because common paints won't adhere solidly to such smooth, dense materials as plastic tile, your paint job is almost certain to turn out badly. Even when plastic tile are roughened with coarse steel wool or other abrasives a lasting paint job is not assured. Moreover, repainting cannot equal the original finish even with glossy enamel and extreme care in brushing to get a smooth job. It's best to remove and replace the old tile.



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Items from All Outdoors

What does automation have to do with outdoor recreation?

"Everything," says Bob McCulloch. "With a shorter work week, working men will spend more time in the outdoors with their families."

A forceful visionary who describes himself as a "grease monkey," but is better known as the rugged individualist who parlayed a \$1000 investment in a machine shop at the height of the depression into a personal fortune of \$30 million by manufacturing superchargers, chain saws and outboard motors, McCulloch is currently building his own city, a utopian community devoted to outdoor recreation.

In just two years he has turned a desolate spread of sand and sagebrush on the banks of 45-mile-long Lake Havasu in Arizona into a community boasting a bank, a supermarket, a medical clinic, a school, a church, three restaurants, a modern hotel and marina and a 56-unit apartment complex. There are 40 miles of paved streets and 3000 private homes are being built. There are also 11,000 palm trees (planted full-grown) and a sandy beach (hauled in by truck). There is a golf course and a shooting range. Lake Havasu is renowned for its fishing, and there are acres of open country for hunting.

McCulloch is gradually moving his entire industrial complex (now employing 4000 people) to Lake Havasu City, and this is where his plan becomes revolutionary.

"This will be a retirement community for the young," he exclaims. "My plan is to take the jump on automation and install the four-hour work day. It's going to come anyway, but we're planning for it by establishing our city in a natural center for outdoor activity. I want to attract the expert machinist who has some money saved, doesn't want to retire completely, but would like to spend more time fishing or boating or just plain enjoying life with his family. We'll get the exceptional worker and he'll be a happier man."

It can get extremely hot in Arizona in the summer and we asked about this.

"Everything here is airconditioned," he said. "It's not a bit different from heating your house in the winter up north. And for relaxing the heat is always more pleasant than the cold."

STUART JAMES

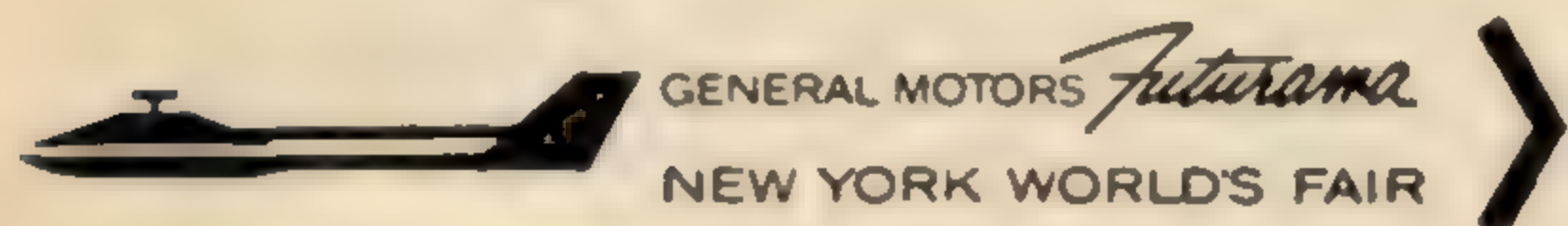
Outdoors Editor

POPULAR MECHANICS



GIVE YOUR GM CAR THE PROTECTION IT DESERVES!

Everything's explained in the important Owner Protection Plan booklet you get with any new GM car or truck. Handy tear-out coupons outline the recommended services you need to protect your investment. Crankcase ventilation valve service is a typical recommendation for a cleaner, better performing engine. Your General Motors dealer is your best assurance of Genuine GM Parts, factory-trained technicians and modern Guardian Maintenance facilities. Visit your GM dealer soon. And remember, a car that is serviced regularly is a safer car to drive.



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Start something fresh!

Freshest smoke you ever
put into a pipe

BOWL of ROSES

Aromatic Mixture

You never thought a rich, satisfying smoke could be so *fresh*! An outdoor kind of freshness you get only in Bowl of Roses...because only Bowl of Roses blends this bouquet of flavor with its hearty, satisfying tobaccos.

Try Bowl of Roses for *your* next pipeful. Start something *fresh*!...she'll like it almost as much as you do.



Another fine product of United States Tobacco Company

New on the Market

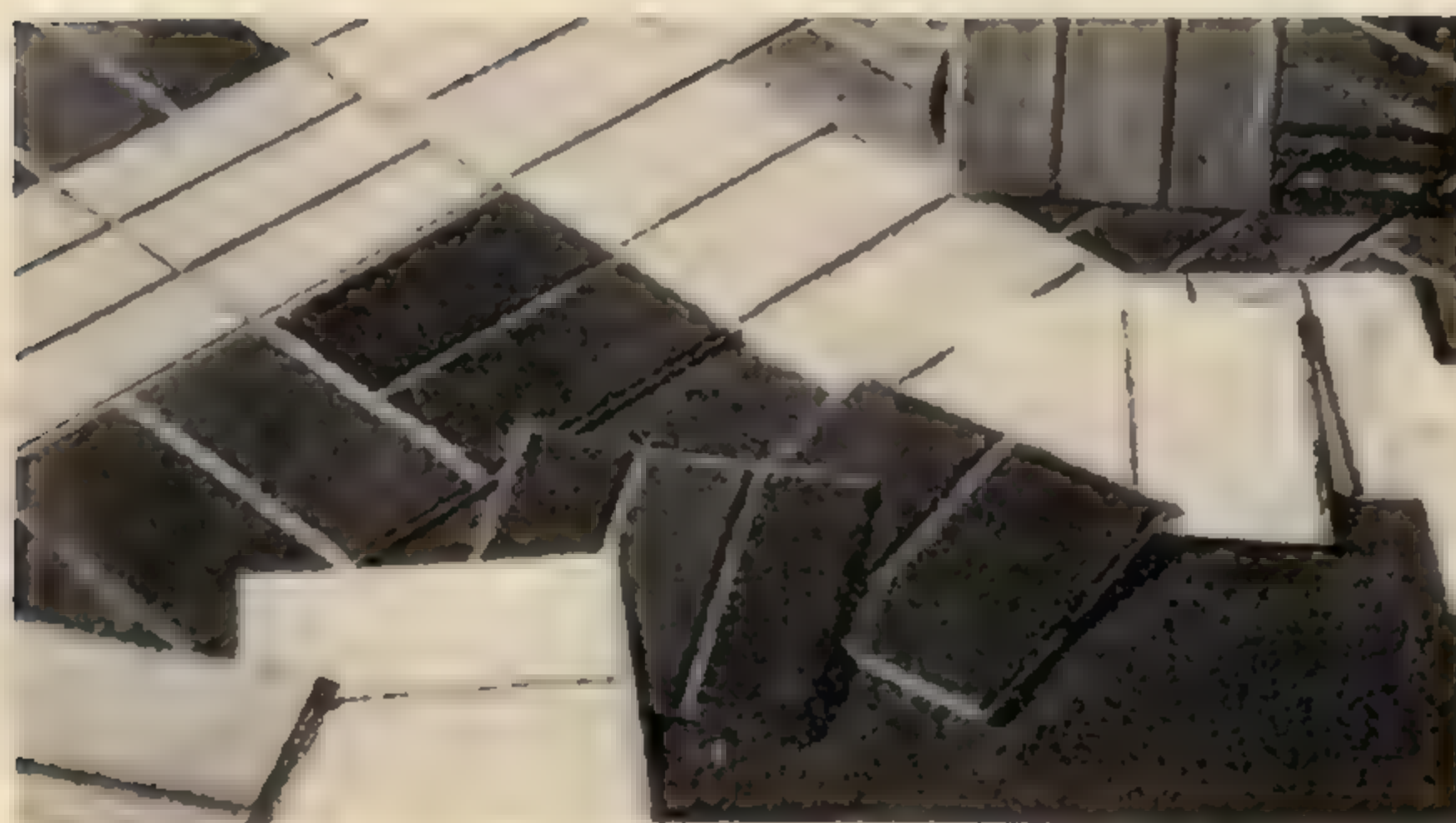
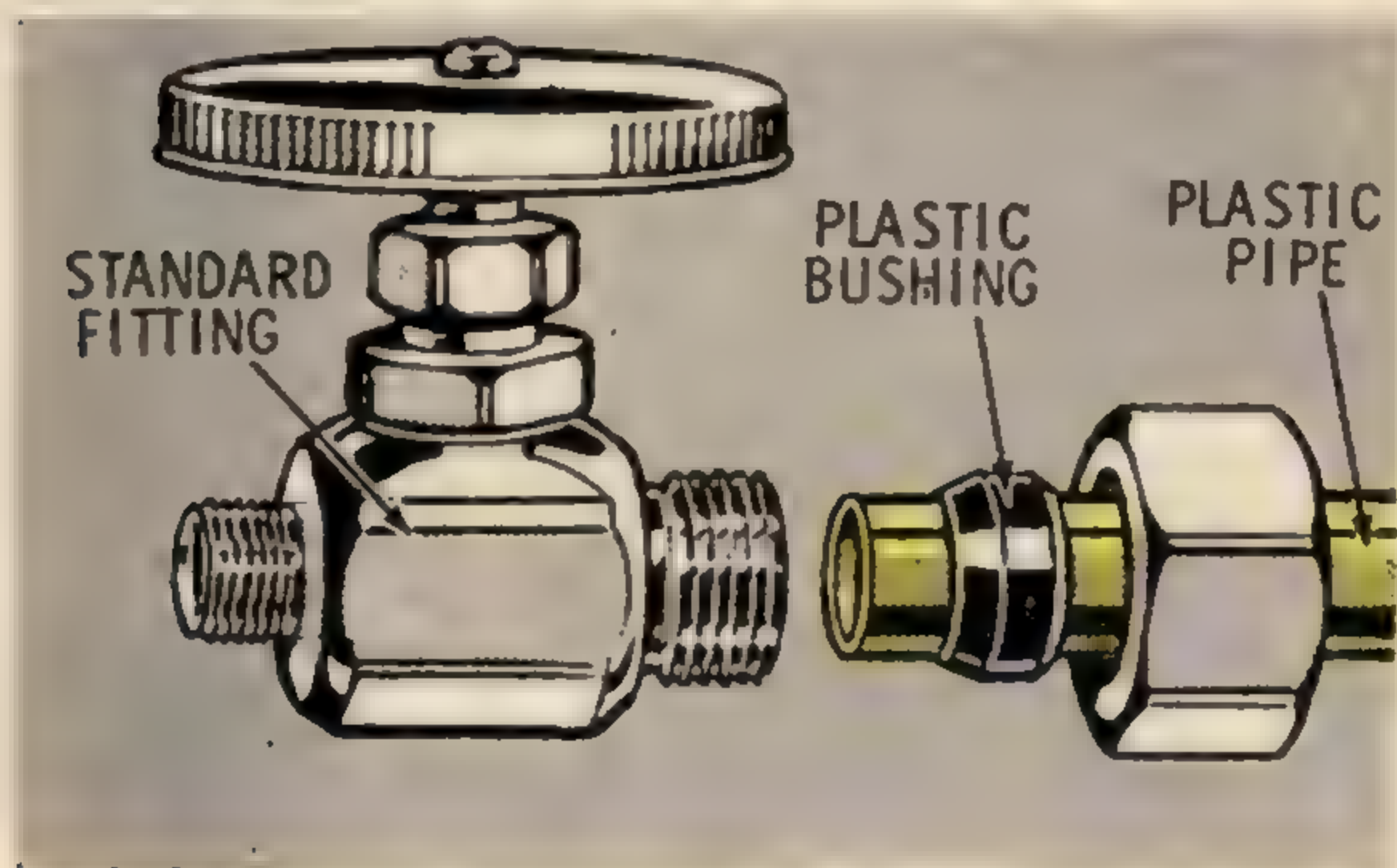
Keep out chilling drafts and crawling insects with Skuff Guard sets. Each set contains a threshold and kickplate of extruded aluminum. The kickplate has a vinyl weatherstrip that presses against bevel of the threshold. In 32 and 36-in. sizes, with $\frac{1}{2}$ or $\frac{3}{4}$ -in. threshold heights. Cost \$6.49 and \$6.98, respectively. Skuff Guard, 5843 S.W. 60 St., Miami, Fla.

New plastic pipe, of polyvinyl dichloride, may be used in conjunction with copper tubing and standard fittings. Comes in $\frac{1}{2}$ and $\frac{3}{4}$ -in. sizes. To make connection, you slide fitting nut on pipe, then solvent-weld a plastic bushing in place. Plastic fittings are used where lengths of plastic pipe must be joined. Genova Prods., 241 S. Grand Traverse St., Flint, Mich.

Brick floor without bricks: The textured surface of Colonial Brick vinyl floor tile looks and feels like the real thing. In red, pink and white, with either two or three "bricks" to each 9x9-in. tile. For added realism, tiles of the same color vary slightly in shade. "Mortar" grout surrounds each brick. Retail price is \$1.25 per sq. ft. Made by Kentile Floors, 58 2nd Ave., Brooklyn, N.Y.

Paper a wall with metal? It's easy with Chemetal, a wall covering that's made of thin copper laminated to a kraft paper backing. Its surface is treated with chemical reagents to produce unusual random-flow patterns. Available in four color effects at \$2.50 per sq. ft. Applied with same adhesives used with vinyl wall covering. Advanced Resin Prods., S. Norwalk, Conn.

Make emergency signals of your parking lights and directionals by connecting them to the 4-Lite Flip-A-Switch (not shown). When your car is disabled, this dashboard-mounted device blinks the lights on and off simultaneously to warn away other motorists. Made by Hi-Test Premier Prods. and available for \$3.98 from Spencer Gifts, 665 Spencer Building, Atlantic City, N.J.



NEW from Du Pont

for every car with an automatic transmission



DOES TWO JOBS . . . All transmission fluids contain certain additives which wear out with use. Du Pont "T-Seal" is formulated to replace those worn-out additives and to revitalize the transmission fluid.

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IT'S A TUNE-UP . . . Du Pont "T-Seal" renews the efficiency of the transmission fluid itself. Prevents formation of harmful sludge and varnish which could damage precision-built transmission parts. Helps stop slippage and assure quiet, smooth shifting. Prolongs the life of the transmission.

Prevent automatic transmission problems before they start. Get Du Pont "T-Seal" now at service stations and auto supply stores everywhere.

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EXCLUSIVE OFFER— Save up to \$3.00 on a set of Classic 7 Cars "Matchbox" Series—Models of Yesteryear. See the Du Pont display and money-saving coupon where No. "7" products are sold.

Clip out and save A COMPLETE GUIDE TO DO-IT-YOURSELF ALUMINUM

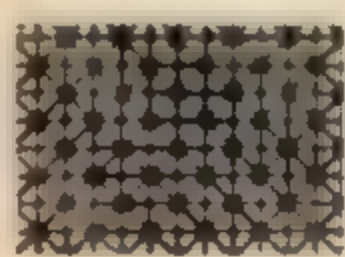
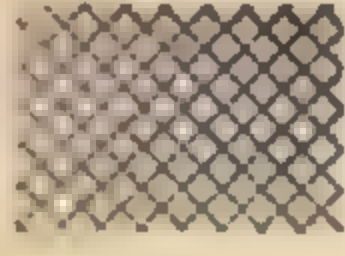
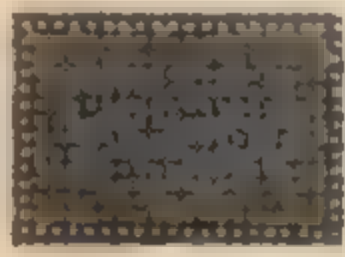
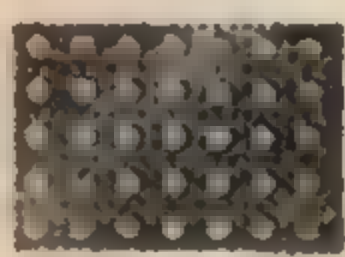
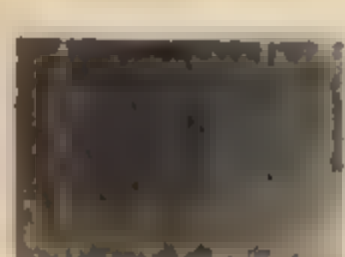


Complete. A handy at-home reference listing for Do-It-Yourself Aluminum. The variety and types of pieces available, the different sizes, styles, suggested retail prices—plus a complete listing of current project booklets and plans. We think you'll find it a valuable and handy work-saver in your shop.

REYNOLDS DO-IT-YOURSELF ALUMINUM
can be worked with ordinary woodworking tools

REYNOLDS DO-IT-YOURSELF ALUMINUM SHEET

Plain, perforated and embossed

	Item No.	Description	Suggested Retail Price
	1	Plain aluminum sheet 36" x 36"—.020"	\$2.99/sheet
	111	Plain aluminum sheet 36" x 36"—.040"	6.89/sheet
	125	Plain aluminum sheet 32" x 33" (approx)—.008" (thin sheet)	.98/sheet
	34	Union Jack sheet 36" x 36"—.025"	2.99/sheet
	126	Union Jack sheet 32" x 33" (approx)—.008" (thin sheet)	1.49/sheet
	31	Cloverleaf sheet 36" x 36"—.025"	2.99/sheet
	127	Cloverleaf sheet 32" x 33" (approx)—.008" (thin sheet)	1.49/sheet
	33	Lincane sheet 36" x 36"—.020"	2.99/sheet
	133	Hexcane sheet 36" x 36"—.040"	6.89/sheet
	2	Leather Grain embossed sheet 36" x 36"—.020"	2.99/sheet
	27	Wood Grain embossed sheet 36" x 36"—.020"	2.99/sheet
	28	Square embossed sheet 36" x 36"—.020"	2.99/sheet
	128	Moresque sheet 32" x 33" (approx)—.008" (thin sheet)	1.49/sheet

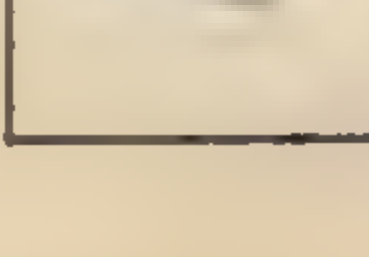
DO-IT-YOURSELF ALUMINUM ROD & BAR

Can be cut, drilled, sawed, filed and shaped. Needs no painting for protection (yet takes to paint beautifully).

	Item No.	Description	Suggested Retail Price
	3	3/8" x 6' Rod	\$1.29/length
	3-A	3/8" x 8' Rod	1.72/length
	4	1/2" x 6' Bar	1.69/length
	4-A	1/2" x 8' Bar	2.25/length
	5	1/4" x 6' Bar	1.98/length
	5-A	1/4" x 8' Bar	2.64/length
	96	6' T-Section	1.79/length
	96-A	8' T-Section	2.39/length

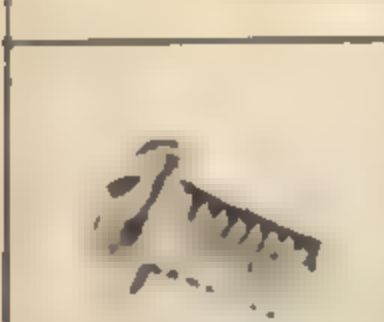
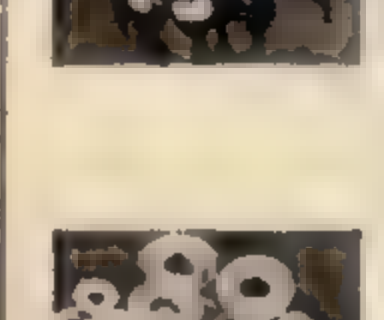
REYNOLDS DO-IT-YOURSELF ALUMINUM TUBING

Rustproof and corrosion resistant. Ideal for outdoor furniture, table and chair legs, support poles, etc.

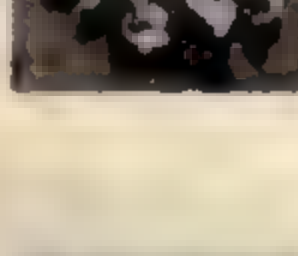
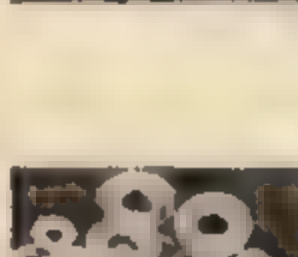
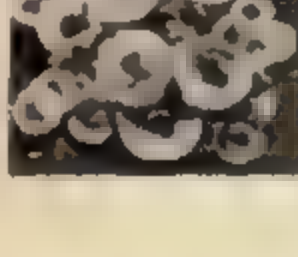
	Item No.	Description	Suggested Retail Price
	8	3/4" x 6' Tubing	\$1.79/length
	8-A	3/4" x 8' Tubing	2.39/length
	9	1" x 6' Tubing	1.89/length
	9-A	1" x 8' Tubing	2.52/length
	10	1 1/4" x 6' Tubing	1.99/length
	10-A	1 1/4" x 8' Tubing	2.65/length
	42	3/4" End Plugs	.05/plug
	43	1" End Plugs	.05/plug
	44	1 1/4" End Plugs	.05/plug
	48	3/4" Flange	.49/each
	49	1" Flange	.49/each
	50	1 1/4" Flange	.50/each
	51	3/4" T-Butt	.49/each
	52	1" T-Butt	.49/each
	53	1 1/4" T-Butt	.50/each
	54	3/4" 90° Elbow	.60/each
	55	1" 90° Elbow	.65/each
	56	1 1/4" 90° Elbow	.85/each
	77	Oval Embossed Tubing	1.89/length
	78	Hexagonal Embossed Tubing	1.89/length
	88	3/4" Splicer for Round Tube	.60/each
	89	1" Splicer for Round Tube	.65/each
	90	1 1/4" Splicer for Round Tube	.85/each
	91	3/4" Adjustable Elbow	1.19/each
	92	1" Adjustable Elbow	1.29/each
	93	1 1/4" Adjustable Elbow	1.39/each
	104	1" x 6' Square Tube	1.98/length
	114	3/8" Coiled Tubing—25'	2.89/coil
	185	7/8" x 6' Tubing	2.19/length
	Items 8, 9 and 185 Telescope		

REYNOLDS DO-IT-YOURSELF ALUMINUM ANGLES

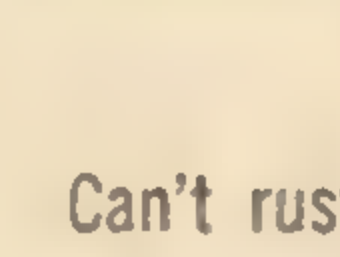
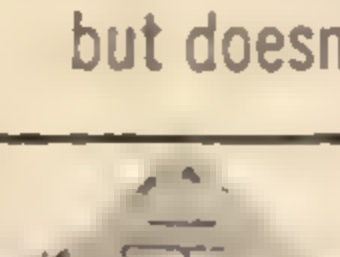
Including hinges, sliding door track, corner posts and H-sections. Easy-to-use, saves time, work and money for a thousand different jobs.

	Item No.	Description	Suggested Retail Price
	6	1/4" x 6' Angle	\$1.99/length
	6-A	1/4" x 8' Angle	2.65/length
	7	1/8" x 6' Angle	1.79/length
	7-A	1/8" x 8' Angle	2.39/length
	B-14	1" x 1" x 1/8" x 8' Angle	3.15/length
	B-15	3/4" x 3/4" x 1/4" x 8' Angle	1.59/length
	67-S-4	4' Track Set for 1/8" Materials, including fasteners	2.49/set
	67-S-6	6' Track Set for 1/8" Materials, including fasteners	3.39/set
	68-S-4	4' Track Set for 1/4" Materials, including fasteners	2.98/set
	68-S-6	6' Track Set for 1/4" Materials, including fasteners	3.98/set
	72	6' Track for 3/4" Materials and Aluminum Frames	2.98/length
	95-S-4	4' Track Set for 1/2" Materials, including fasteners	3.39/set
	95-S-6	6' Track Set for 1/2" Materials, including fasteners	4.78/set
	101	8' Corner Post, 1/4" Materials	3.19/length
	102	8' Corner Post, 1/2" Materials	4.29/length
	103	8' Corner Post, 3/4" Materials	5.39/length
	105	8' H-Section, 1/4" Materials	2.69/length
	106	8' H-Section, 1/2" Materials	3.19/length
	107	8' H-Section, 3/4" Materials	3.88/length
	108	72 1/2" x 1 1/4" Continuous Hinge	3.39/length
	112	8' Corner Post, 3/8" Materials	3.88/length
	113	8' H-Section, 3/8" Materials	2.98/length
	117	8' U Section for 1/4" thick panels	1.98/length
	118	8' U Section for 3/8" thick panels	1.98/length
	119	8' U Section for 1/2" thick panels	2.49/length
	120	8' U Section for 3/4" thick panels	2.49/length
	161	1/2" x 6' Angle	1.19/length
	161-A	1/2" x 8' Angle	1.59/length

ALUMINUM FASTENERS, WIRE, MISCELLANEOUS

	Item No.	Description	Suggested Retail Price
	16	6' Brace	\$0.79/length
	16-A	8' Brace	1.05/length
	21-B	10—24 x 1/2" Round Head Machine Screws and Nuts	.25/bag
	21-C	10—24 x 3/4" Round Head Machine Screws and Nuts	.25/bag
	21-D	1/4"—20 x 1" Round Head Machine Screws and Nuts	.25/bag
	21-E	1/4"—20 x 1 1/2" Round Head Machine Screws and Nuts	.25/bag
	21-G	6 x 3/8" Pan Head Self-Tapping Screws	.15/bag
	21-H	6 x 1/2" Pan Head Self-Tapping Screws	.15/bag
	21-I	8 x 3/4" Pan Head Self-Tapping Screws	.15/bag
	21-M	3/32" x 1/4" Brazier Head Rivets	.15/bag
	21-N	1/8" x 3/8" Brazier Head Rivets	.15/bag
	21-O	1/8" x 3/4" Brazier Head Rivets	.15/bag
	21-P	1/4"—20 x 2 1/4" Slotted Rd. Head Machine Screws and Nuts	.25/bag
	21-Q	1/4"—20 x 1 1/2" Slotted Rd. Washer Head Machine Screws and Nuts	.25/bag
	21-R	#6 x 3/8" Slotted Flat Head Type "A" Self-Tapping Screws	.15/bag
	21-S	#8 x 1/2" Slotted Flat Head Type "A" Self-Tapping Screws	.15/bag
	21-T	#10 x 3/8" Slotted Flat Head Type "A" Self-Tapping Screws	.15/bag
	21-U	#10 x 3/8" Pan Head Type "A" Self-Tapping Screws	.15/bag

ALUMINUM FASTENERS, WIRE, MISCELLANEOUS (Continued)

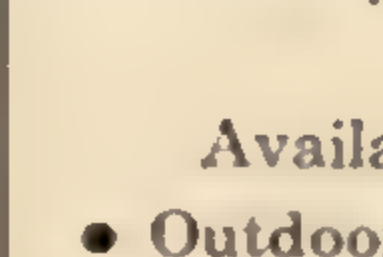
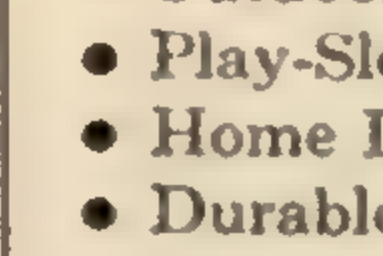
	Item No.	Description	Suggested Retail Price
	21-V	#6 x 1/2" Slotted Flat Head Type "A" Self-Tapping Screws	.15/bag
	21-W	#8 x 3/4" Slotted Flat Head Type "A" Self-Tapping Screws	.15/bag
	21-X	#8 x 1" Slotted Flat Head Type "A" Self-Tapping Screws	.15/bag
	818-P	2 1/2" Spiral Grip Roofing Nails	.25/bag
	819-P	1 3/4" Screw Grip Roofing Nails	.25/bag
	828-P	10d—2 3/8" Plain Wood Siding Sinker Head Nails	.25/bag
	850-P	4d—1 1/2" Plain Common Nails	.15/bag
	47	Corner Braces	.08/set
	85	Complete Soldering Tool and Accessories	1.98/set
	86	3 Refill Brushes for Soldering Tool	.49/set
	87	Solder—4 pieces of solder per skin-packed card	.59/card
	97	Picture Frame	1.89/length
	109	Craft Wire—60' .035" Gauge	.29/each

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	Item No.	Description	Suggested Retail Price
	30	6' Storm Sash	\$1.14/length
	30-A	8' Storm Sash	1.49/length
	30-S	Storm Sash Glazing Spline 150' reel	.04/foot
	25	Corner Locks	.44/set
	26	Screen Hangers	.39/set
	37	Interchangeable Hangers	.98/set
	38	Splicer for Items #24 and #30	.10/each

SCREEN MATERIALS

	Item No.	Description	Suggested Retail Price
	24	Screen Frame Section with Aluminum Spline—6'	\$1.14/length
	24-A	Screen Frame Section with Aluminum Spline—8'	1.49/length
	38	Splicer for Items #24 and #30	.10/each
	16	6' Brace	.79/length
	16-A	8' Brace	1.05/length

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Noteworthy New INVENTIONS

By M. J. Pedersen

The four "feet" of Project Apollo's Lunar Excursion Module (LEM), which is scheduled to soft-land two American astronauts on the moon by 1970, earned patent 3,175,789 for Josef F. Blumrich of Marshall Space Flight Center, Huntsville, Ala. Made of a thin sheet of material such as aluminum, these bowl-shaped landing pads are designed to support the space vehicle regardless of the type of surface it encounters. Each foot collapses in a radial direction to absorb the shock on landing.

Railroad tie tester that rides the rails on a trucklike vehicle may save the railroads thousands of dollars a year in maintenance. The instrument first shoots a cone of gamma rays into the wooden ties and then indicates, through readings of the reflected energy, whether the ties are sound

or decayed. Patent 3,176,134 went to James J. Wright of Cleveland for his invention.

Pencil-matches that may well become *de rigueur* for bridge parties, golf matches, business conferences and informal social gatherings, are exactly what the name implies: a match and a pencil in one. A graphite coating on the tip of the matches enables the user to write by pressing lightly and obtain a light when he strikes harder. Having solved a distressing problem, Nelson J. Waterbury of New York earned patent 3,175,685 for his idea.

Pet dryer is also a pet pen which frees the owner from "minding" an animal while it dries safely and quickly. Consisting of two chambers—one to provide a gentle flow of heated air over the animal and the other to store the heating equipment—the dryer was awarded patent 3,175,534 for Robert E. Pollard, Apple Valley, Calif.

Absentminded drivers who forget to turn off auto headlights when getting out of their cars, may now be warned in time by a sound-signaling device—connected to a vehicle's electrical system—that earned patent 3,172,080 for George L. Webb and Erich E. Late, Lancaster, Ohio.

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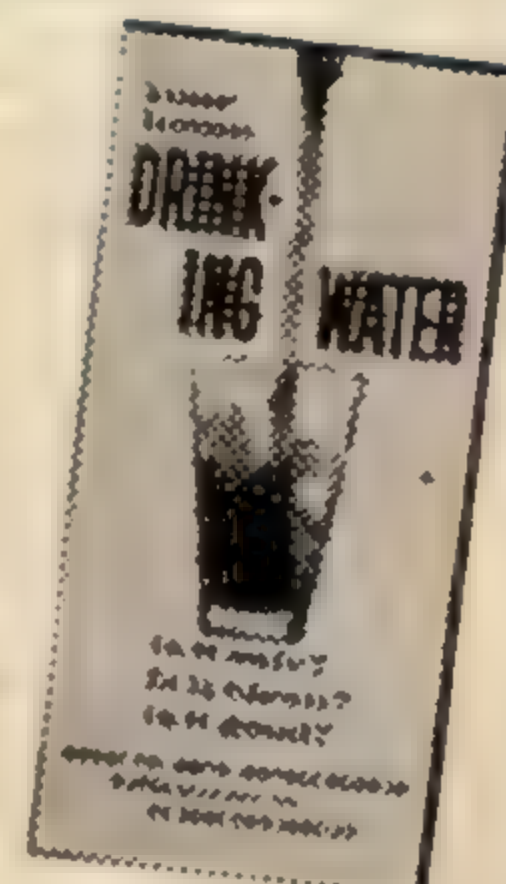
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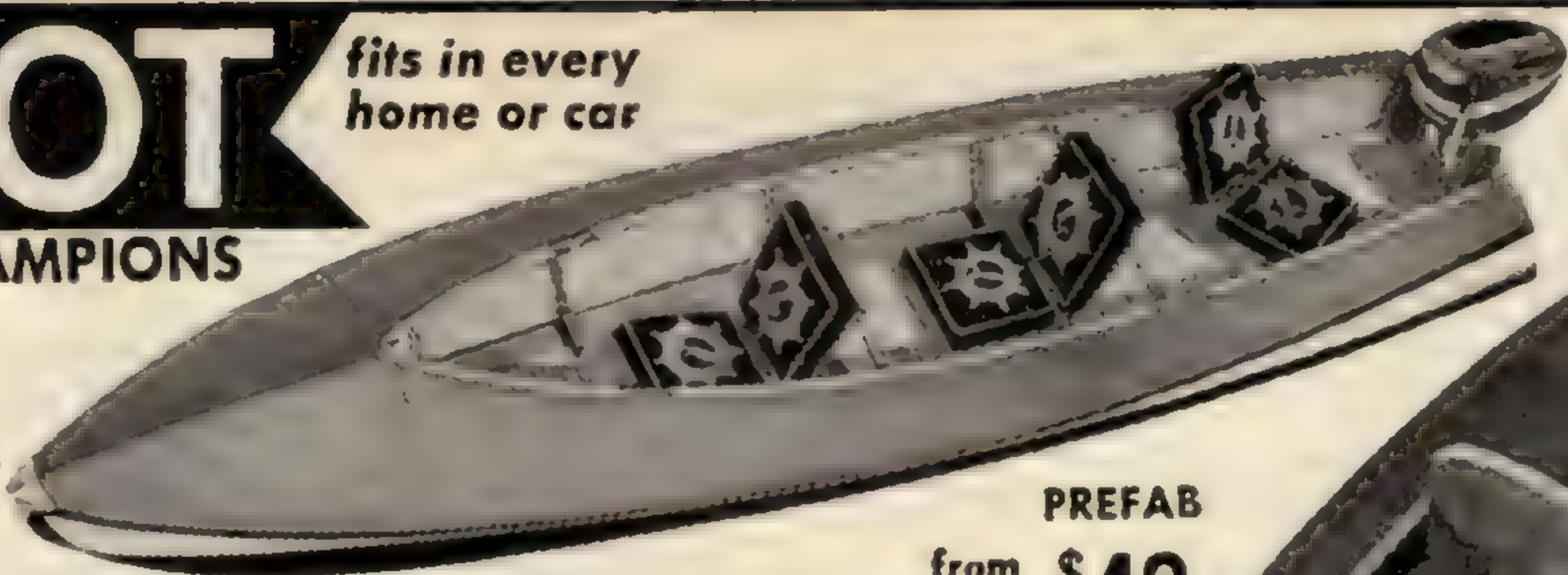
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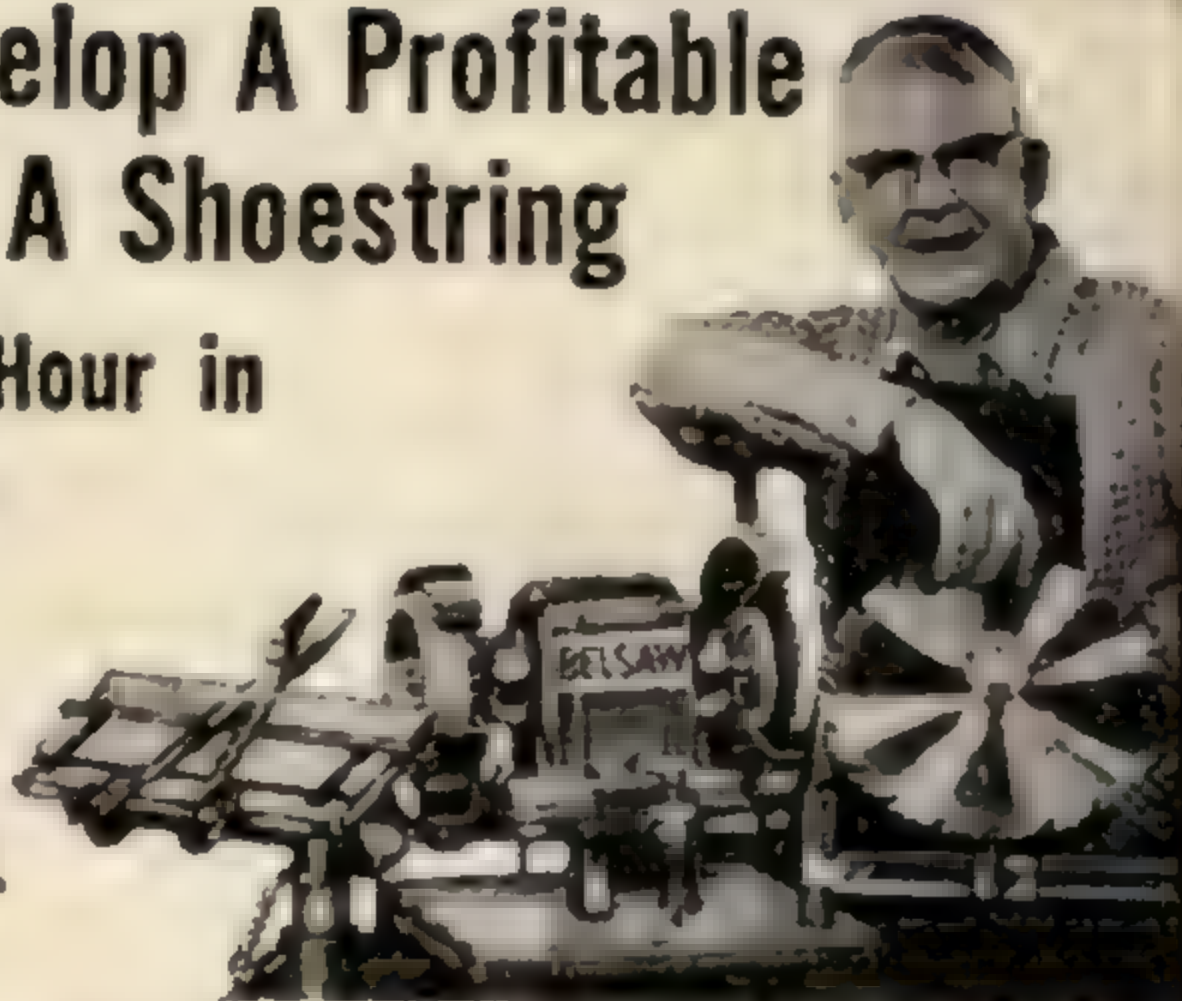
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8-mm Movies Grow Up

Take bigger, brighter, sharper home movies with a revolutionary no-fuss cartridge-loading film

BRIGHTER, SHARPER IMAGES on your 8-mm home movie screen—that's the promise of Eastman Kodak's new Instamatic Super 8 system.

Primary reason for Super 8's improved picture quality is the fact that its frames are 52 percent larger than standard 8-mm. It puts about 50 percent more light on the screen, and requires less magnification. Definition and shadow detail are much improved, and stray light becomes less trou-

blesome to the viewer.

The larger frames were achieved by:

- Reducing the size of the sprocket holes and moving them closer to the edge.
 - Reducing the space between frames.
 - Relocating the sound-stripe area.
- (Sound striping is optional.)

Due to the larger frames, there is a loss in running time of about 10 percent—a small price to pay for the improved quality, however. Another small catch: The film cannot be used in existing cameras and projectors.

The Super 8 system uses an improved Kodachrome II Type A film which comes in disposable cartridges. Just drop the film into the camera. You don't even have to

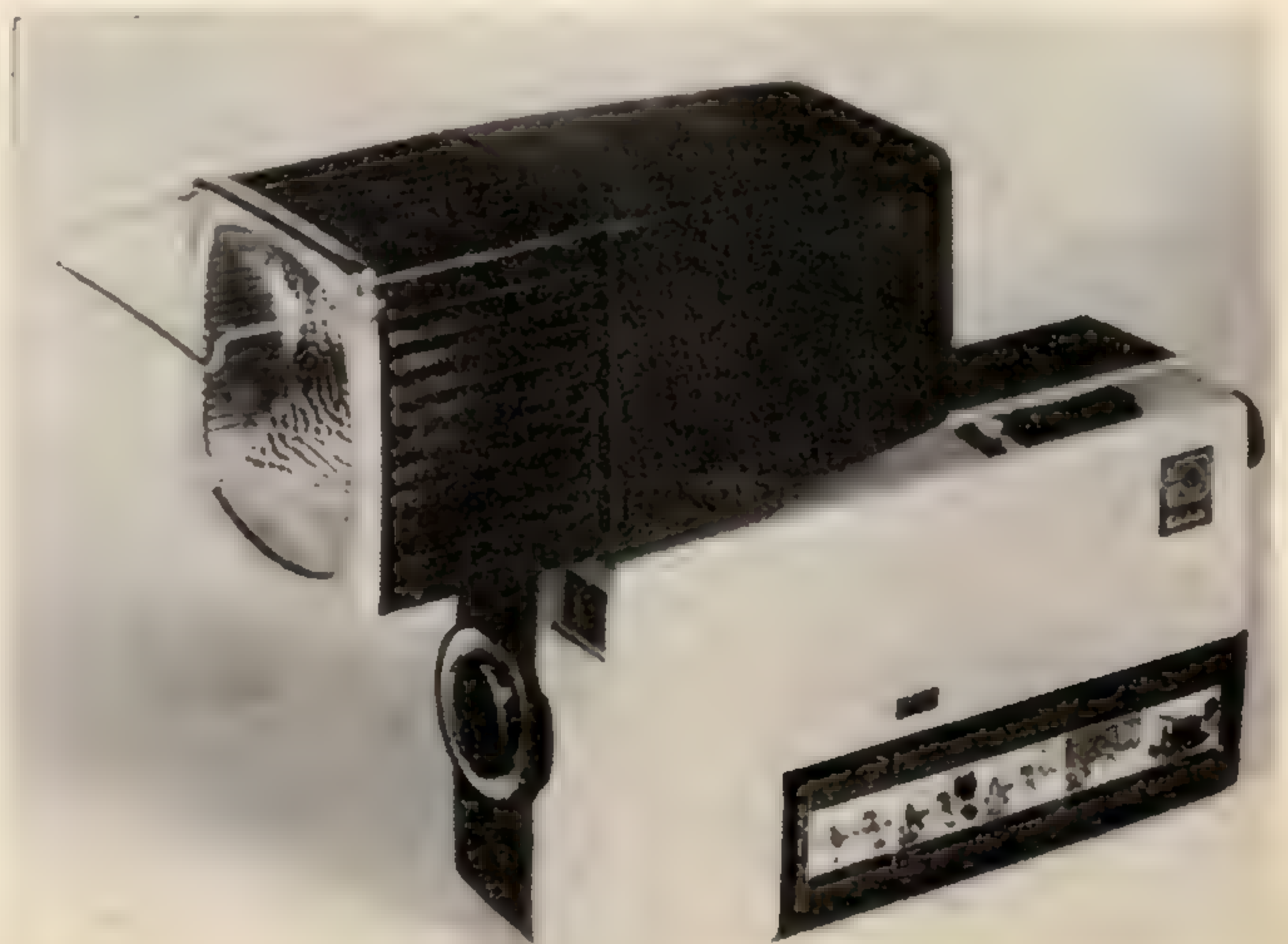


LOAD IN SECONDS: Cartridges of new indoor-outdoor color film slip right into camera. In electric-eye cameras, a notch in cartridge sets the film speed

HARD WORKING PROJECTOR, the Instamatic M60, not only threads the film itself, but also rewinds automatically when it reaches end of 200-foot reel



BUDGET-PRICED CAMERA, the Instamatic M2 (shown with movie light), has f:1.8 lens, manual exposure control. Like other models in line, it's battery operated



thread it into the advance mechanism or run off a leader. The camera does it for you. And, since the cartridge contains 50 feet of film in single width, it does not have to be turned around and re-run through the camera. (Standard 8-mm comes in double-width 25-foot rolls and magazines. To get 50 feet of pictures you must expose half the film, turn it over and expose the other half. The processor then separates the two halves and splices them end to end into a single 50-foot roll.)

Price of the new film, says Kodak, will be moderately higher than that of standard Kodachrome II roll film, which sells for \$2.65. Processing will cost \$1.95, the same as standard Kodachrome II.

At present, Kodak offers three cameras in the new format, ranging in price from about \$50 to about \$175. Two of these have automatic exposure control, and the de-

lux model has a zoom lens. All three have built-in filters for shooting the Type A film outdoors. To shoot indoors, just snap a special movie light onto the camera. The outdoor filter is removed from the aperture automatically.

The projector line includes five silent models selling for under \$65 to under \$205. All are self threading; one offers automatic rewind, and one converts from Super 8 to standard 8-mm. There's also a sound projector for under \$600.

Besides the Kodak equipment, home movie buffs will have a choice of Super 8 cameras and projectors from many other manufacturers. These include Yashica, Bell & Howell, Keystone, DeJur, Argus, Eumig, Paillard and Bauer. Other firms are expected to join in before long.

—Arthur J. Maher

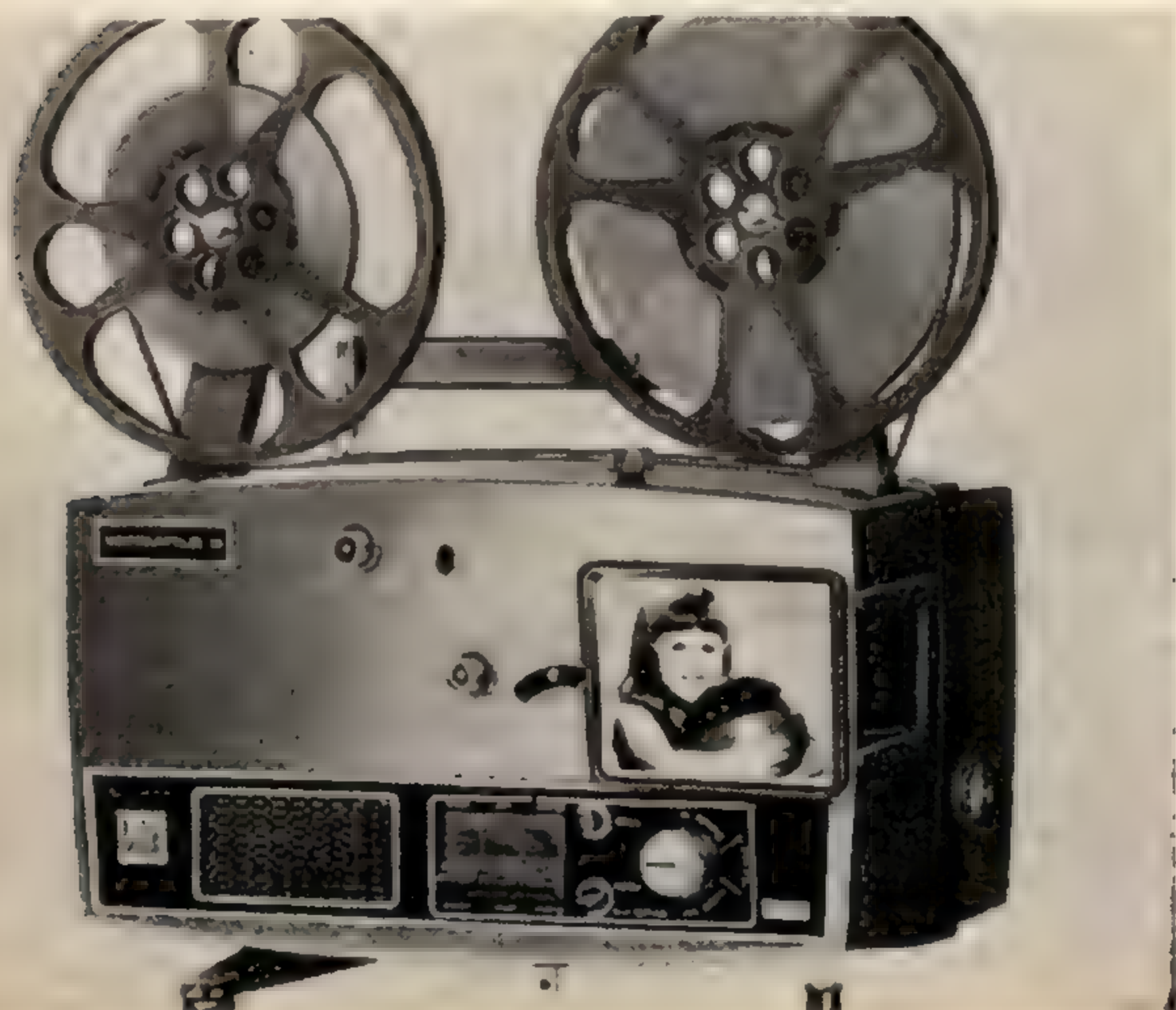
★★★



LARGER IMAGES of improved format let more light reach the screen, reduce necessary magnification. Frames' center location also steadies projected image

TURN A KNOB on DeJur's Versatile I and II projectors and you can show either standard or Super 8-mm film. These models also have built-in preview screens

THROUGH-THE-LENS viewing eliminates parallax in the automatic Bauer C-1 Camera. Other features include 9 to 36-mm zoom lens and choice of three speeds





MARLIN

Sleek Fish from Rambler

By Alex Markovich



EVEN MOTHER-IN-LAW should be quite happy in the rear seat of the Marlin. There's head and legroom galore. Armrests come with the optional bucket-seat package. The headliner is of a sound-absorbent foam

"**M**AN, THAT LOOKS TOUGH," approved a freckle-faced urchin. His crew-cut companion, also about 11 or 12, had his face pressed against the side window, studying the interior and fogging up the glass.

The object of their admiration was a Rambler Marlin, Detroit's latest entry in the sporty fastback field. I had parked our test car to make a phone call and the sidewalk booth offered an excellent chance to eavesdrop. When Freckles began absently tweaking the aerial, I hastily concluded my call.

When I pounded up, Freckles demanded, "Hey, let's see you burn some rubber."

It's that kind of car. People think it's a sports car. It's really just a Rambler Classic in wolf's clothing—which isn't at all bad, as long as you're not expecting an honest-to-goodness sports car.

In truth, the Marlin is hard-pressed to burn rubber. The only way I could manage it with our 270-hp automatic equipped with airconditioning was to rev up a storm in Neutral, jam the stick into Low and keep my fingers crossed. Yet acceleration is more than respectable. Shifting manually from Low to D-2 at 45 mph, I cranked

out 0-60 in 10.8 seconds. Starting in D-1 and letting the box think for itself cost 1½ seconds. The 40-60 run took 6.1 seconds, 50-70 took 7.2. Gas mileage? At 60 mph (65 on the speedo) I got 18.14 mpg.

The big plus is one you don't expect in a fastback: acres of passenger space, even in back. The interior is neatly finished, with no glue drippings or misaligned panels. The well-chromed dash is gauche, but gauges are legible. There's a built-in crater that serves as a glovebox, and a heater that makes like a Turkish bath. Wind noise is almost completely absent, no matter what the position of the windows.

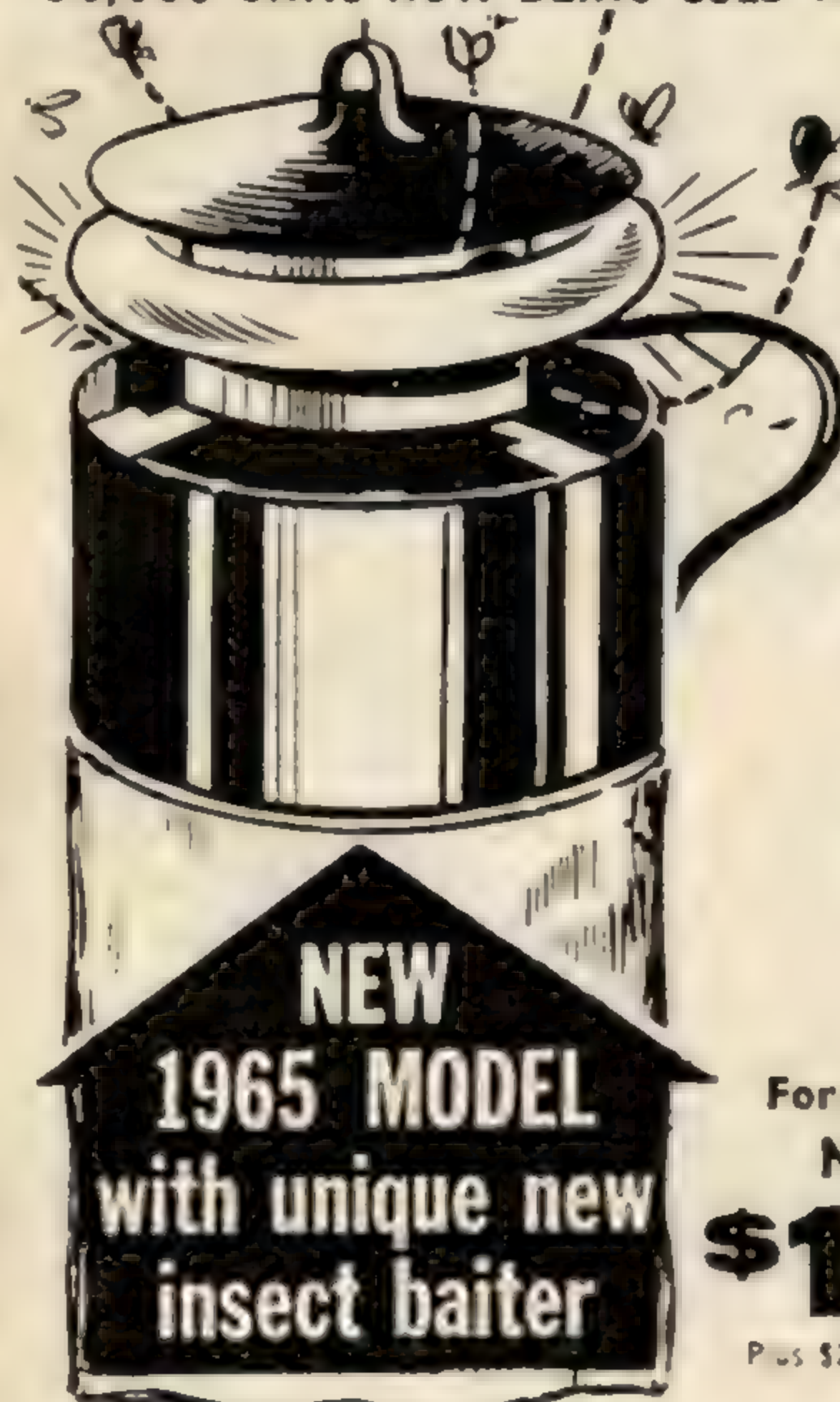
Rambler takes great pride in its attention to detail. Two handy ashtrays slide out easily on ball bearings. The steering wheel and shift lever (ours was on the optional console) are well placed. Seats are deeply cushioned with coils. And a very welcome touch is the metal trim placed along the edges of the curved side windows, a feature all too rare these days.

Ride is on the firm side, but not unpleasantly so. (A second unit pitched hard over old pavement at moderate speed but averaged 15.54 mpg for several hundred

(Please turn to page 38)

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Spotlight on Rambler's Marlin

(Continued from page 36)



YOU LOSE IN THE TRUNK what you gain in the passenger compartment. Skimpy opening leads into a deep but narrow space—making spare hard to reach

miles in Manhattan and on expressways.) Cornering, however, is only fair. It's surprising that Rambler, finally realizing the importance of a performance image, hasn't developed a sportier suspension for the Marlin. There's marked understeer (plowing of the front end) and excessive lean. The optional Classic heavy-duty spring and shock-absorber setup is available on the Marlin, and I strongly recommend it.

The optional power steering transmits little road feel, and its 20.8:1 overall ratio (4.2 turns lock-to-lock) could be a bit faster. But the standard-equipment, power-assisted brakes—discs in front and drums in back—leave nothing to be desired. Pedal pressure is light and progressive. After a series of high-speed panic stops I noticed no fade, no grabbing or swerving.

Generally, it's an easy car to get used to. It plays no unexpected tricks. It does offer distinctive styling without penalizing the passengers; bop your noggin on the rear window of a Mustang fastback a couple of times and you'll really appreciate that rear headroom. Perhaps most important to the Marlin buyer is Rambler's reputation for reliability. The Marlin should follow suit. ★★★

LEAN ON CORNERS is on the hairy side; handling was further hampered by optional airconditioner, which is mounted on already-overweight front end



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I Inhaled

By Robert Gannon

THE GRENADE hit the ground a few yards from my feet and began sizzling violently, spewing a dense cloud of acrid white smoke. The smoke was really gas—war gas—the main gas reportedly used in Vietnam. I stepped into the churning, searing cloud to see what it was like.

This was in April, a few days after the Pentagon had verified the use of “riot control” chemicals. The world press was still reacting, but nearly all the news stories were political; none told what the gases really did. *Popular Mechanics* asked me to find out. I was doing so.

The story really began late in March, when an Associated Press photographer named Horst Fass found himself in the midst of a large-scale South Vietnamese operation. At dusk, the commanders gave the order, “Put on gas masks.” Just before the attack, helicopters were scheduled to spray a cloud of gas over the Viet Cong stronghold.

Fass had no mask. As it turned out, he didn’t need one. The attack was called

TEAR GAS PROJECTILES can be hurled as far as 150 yards with a gas gun. In this instance, Gannon fires gun in same field where he entered cloud of gas



STUMBLING through cloud of CS gas released by a grenade, author Robert Gannon was able to give his firsthand account of how it feels to be gassed

EYES STILL POURING TEARS, author Gannon appears just few seconds after emerging from cloud of CS gas. Choking sensation caused him to tear open his collar



Vietnam War Gas

off. But he did have a story, and back in Saigon he told it to AP reporter Peter Arnett, who cabled it around the world.

When the Pentagon admitted that America had equipped South Vietnamese forces with chemical agents, the world, inevitably, thought back to World War I, to war gas that caused 1,300,000 casualties.

The big question now: Had the United States broken the 1925 Geneva Protocol, the agreement that bans the use of "asphyxiating, poisonous or other gases"?

No, says the State Department. "We are not talking about agents or weapons that are associated with gas warfare . . ." said Secretary Rusk. "We are talking about [gases] commonly adopted by the police forces of the world as riot control agents . . ."

Reportedly, such "riot control agents" have also been used—individually or mixed—by the British in Cyprus and British Guiana, by the French against the Algerians, by U.S. troops during the Canal Zone crisis, by Egypt against Yemen, and constantly by U.S. police against holed-up criminals.

HAND GRENADE containing tear gas (CN) is described as the "work horse" of tear gas arsenal. Grenades spew gas within a second or two after being thrown

Effective though gas may have been in these cases, in Vietnam it didn't work. Either it blew away, or it failed to penetrate the foliage, or the Viet Cong had already left.

First reports out of Vietnam were that the Pentagon was experimenting with three new, secret gases. The truth is that two of the gases have been around since World War I, and none is secret. The three:

CN. This is nothing more than conventional tear gas. The code name comes from the first and second-to-last letters in the chemical name, chloroacetophenone, a fluffy white powder with a sweet honey-suckle fragrance.

Take a slight sniff of CN and you might sneeze. Whiff a little more and your eyes burn, as though you've opened them in a heavily chlorinated swimming pool. You cry. You have trouble breathing, too. You rasp and wheeze. But get to fresh air, and in a couple of minutes, you're good as new. CN has been around for nearly a century.

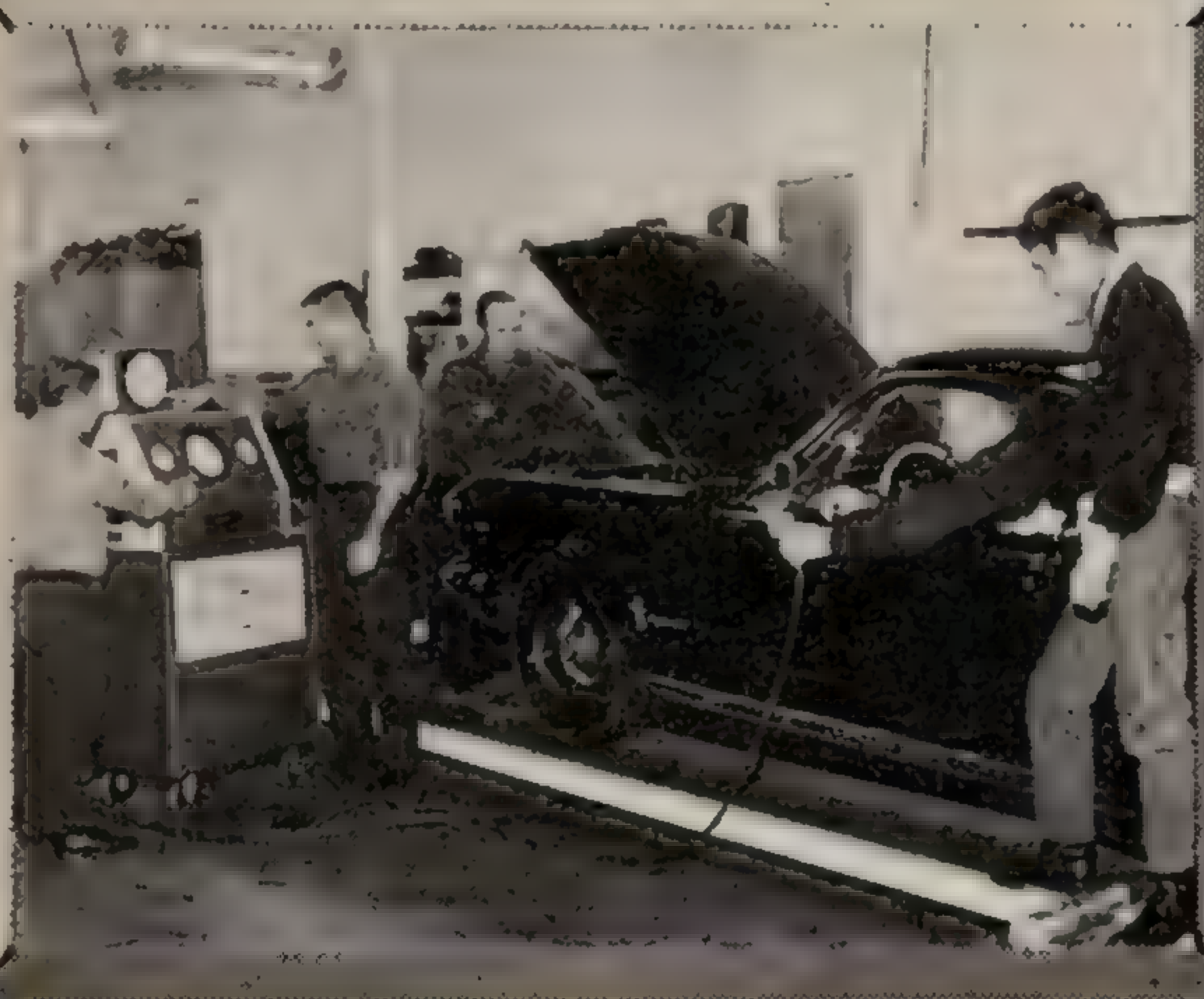
CS. This agent, unlike CN, is so new

(Please turn to page 42)

GAS GUN is 1½-inch caliber launcher for barricade projectiles and riot shells containing gas. It has peep sights adjustable for 50, 75 and 100 yards



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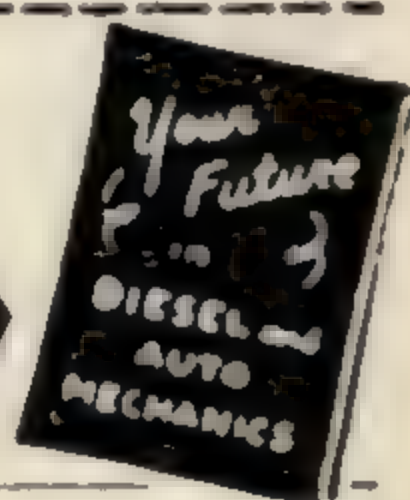
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I Inhaled Vietnam War Gas

(Continued from page 41)

most armed forces field manuals don't even list it yet. Chemically, it's o-chloro-benzalmalononitrile, and the code letters come from the American chemists named Corson and Stoughton who developed it.

CS is hopped-up tear gas—some say eight times as potent as CN. Most of the noncommunist world's supply is made by Federal Laboratories, Inc., of Saltsburg, Pa. And it was in a huge, grassy field out back of Federal that I stepped into the cloud of gas that morning last April.

Instantly, the smoke seared my eyes, and I automatically clamped them shut while tears began to stream down my face. I coughed, and the stinging fumes scorched my throat and pained my chest. My eyelids burned; my cheeks felt rubbed with sandpaper. Coughing, I lost my equilibrium, stumbled, and fell, then opened my eyes. But I couldn't see through the smoke and my tears. I got up, then fell again.

My neck burned, and I yanked open my collar (pulling off the button, I realized later), and though I knew it was only a test, I suddenly could think only that I was choking, that I must breathe, that I must escape. With a touch of panic, I stumbled from the cloud into the sweet, cool, cleansing air.

My eyes continued to water for perhaps 10 minutes. They were red for another 45 minutes or so. My underarms, for some reason, began to sting, and I had a touch of nausea. Far into the night, a headache throbbed in my temples.

The experience was fairly typical, but people vary widely in their reactions. Some choke frighteningly; others retch miserably, without vomiting; still others experience excruciating chest pains. Fortunately, these sidelights passed me by.

DM. This yellowish green or brownish odorless powder was discovered in 1918 by an American, Dr. Roger Adams, and goes by the nickname adamsite rather than by the chemical name diphenylaminechlorarsine. It has never been used much (just missed WWI), though most large police forces stock a few canisters, just in case. A 1942 gas textbook calls DM the Army's standard irritant smoke.

Dan Brigham, military affairs editor of the *New York Journal American*, described DM's effects after being subjected to a controlled dose by the Defense Department:

"One minute you're standing there, curious, but unfrightened," he wrote. "The next, with no warning at all, you're sick as a dog. Your throat burns, eyes water, nose stuffs up—and burns, too."

(Please turn to page 44)

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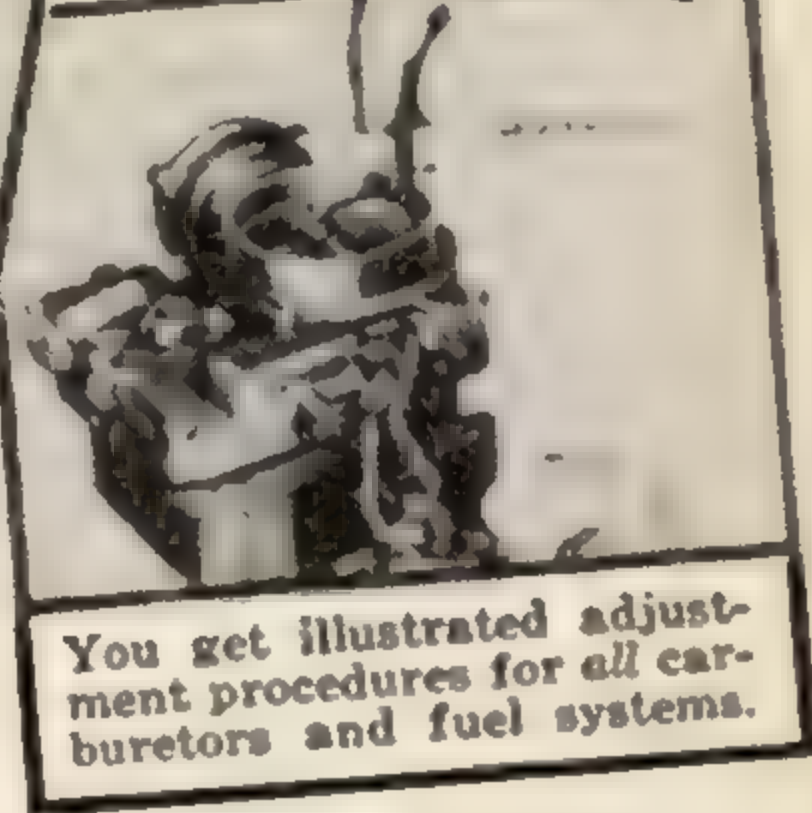
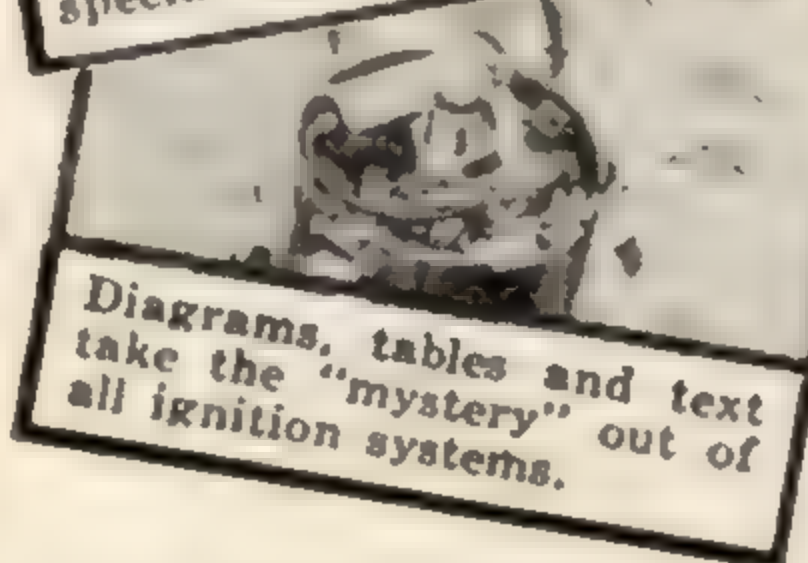
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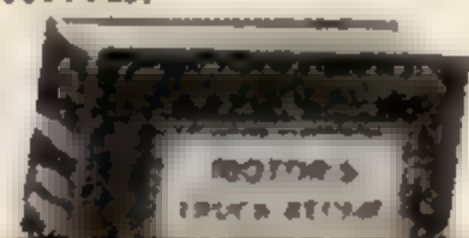
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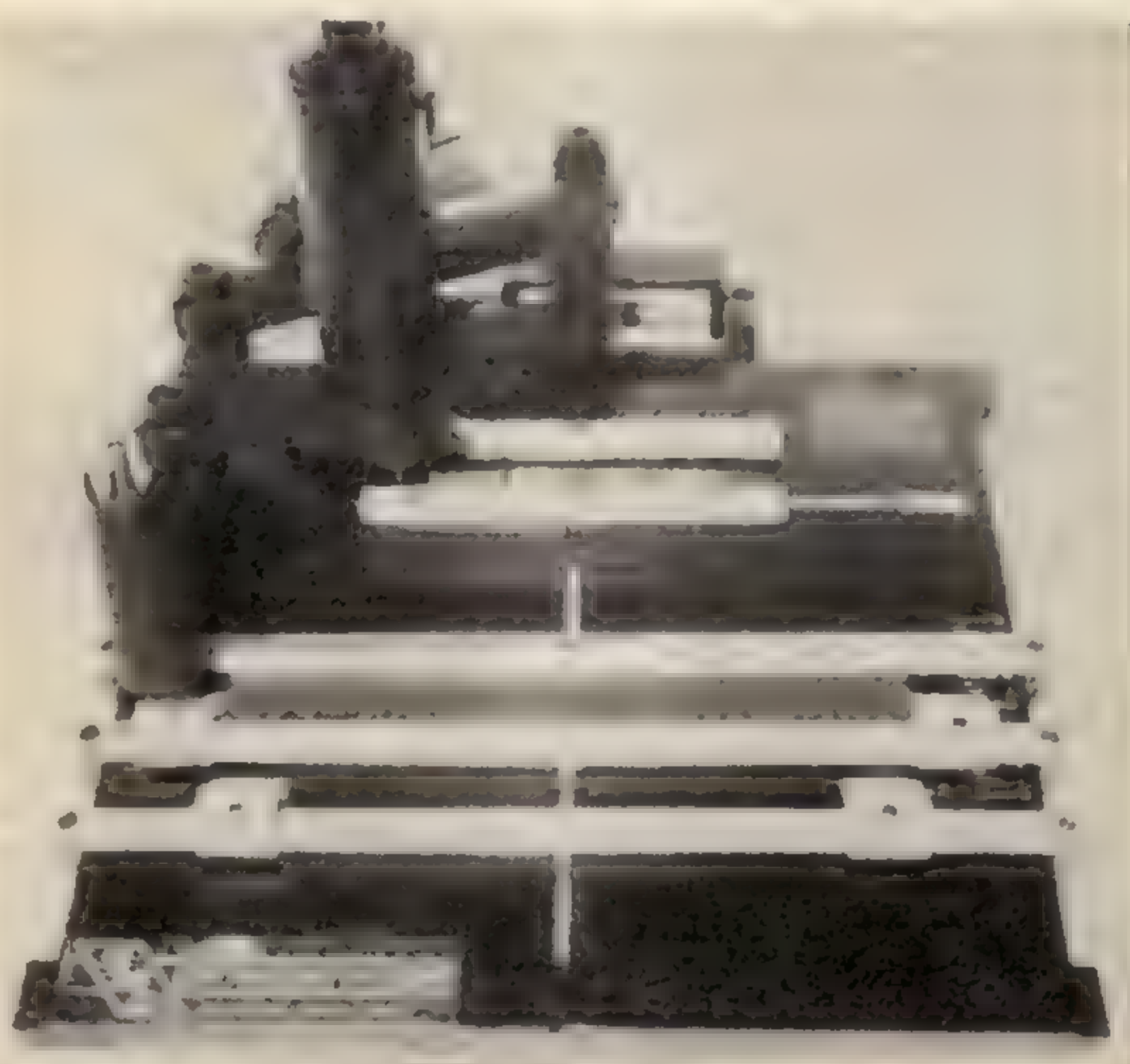
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I Inhaled Vietnam War Gas

(Continued from page 42)

"I wasn't paralyzed, but I might as well have been. I writhed on the floor in pain from muscles that wanted to vomit, but wouldn't cooperate."

In a couple of hours, Brigham was fit again. Others, though, were not so lucky. Said the president of a company that makes DM (he requested anonymity): "I understand that there have been fatalities. It is very possible that the vomiting got out of control, that [deaths] were the result of continuous vomiting without being able to stop." He admits, however, that his knowledge is secondhand.

Dr. David Hilding of Yale University's School of Medicine, points out that "there is absolutely no possibility that everyone sprayed [in Vietnam] escaped permanent harm. . . ."

But was nausea gas (DM) really used in Vietnam? The Pentagon says it was. But interestingly, the suppliers of gases to the government disagree. "Highly unlikely," says Robert B. Reynolds, president of Federal. "Not logical," adds Robert Fisher, president of Fisher Chemical, parent firm of Lake Erie Chemical, a major supplier of gas to the government.

In the past two or three years, according to those in the chemical industry, the Pentagon has put a considerable amount of development work into CS and has virtually ignored CN and DM.

Further, the government recently has purchased huge quantities of CS, barely any nausea gas, and only enough CN, it is believed, for training. The last time Federal Labs sold nausea gas to the Pentagon, in fact, was during the Korean War.

So it seems that the Pentagon's chief stock of nausea gas is left over from 1952. "I would venture to say it would be completely ineffective after seven years," says a Federal spokesman. "DM is very unstable. If the government has any left, it absolutely would not function."

The reason the Defense Department has so little interest in nausea gas, say those in the gas industry, is mainly tactical.

"In Vietnam, the object was to scatter the enemy, not to make him sick. And the best, most effective thing to use is CS."

If this is the case, then, why did the Pentagon open the nausea gas Pandora's box? Two theories: (1) Only a can or two of nausea gas was used—an insignificant quantity. But the Pentagon wanted to cover itself by listing it, in case some reporter had witnessed its usage. (2) The government raised the nausea gas issue on purpose to gauge public opinion—an action singularly productive. ★ ★ ★

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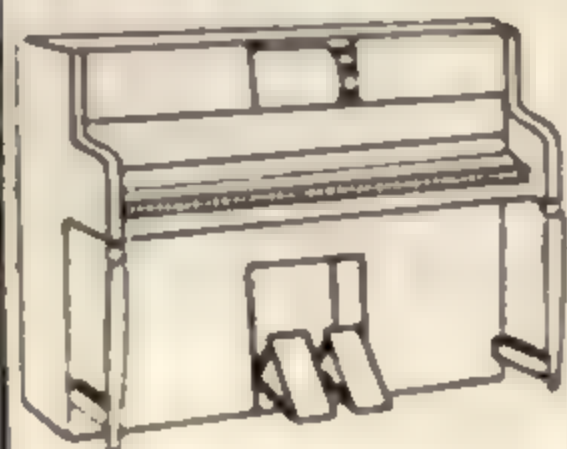
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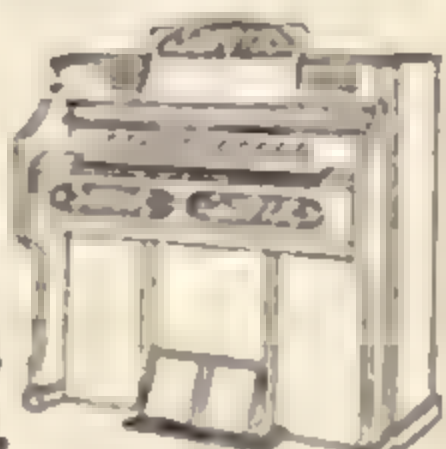
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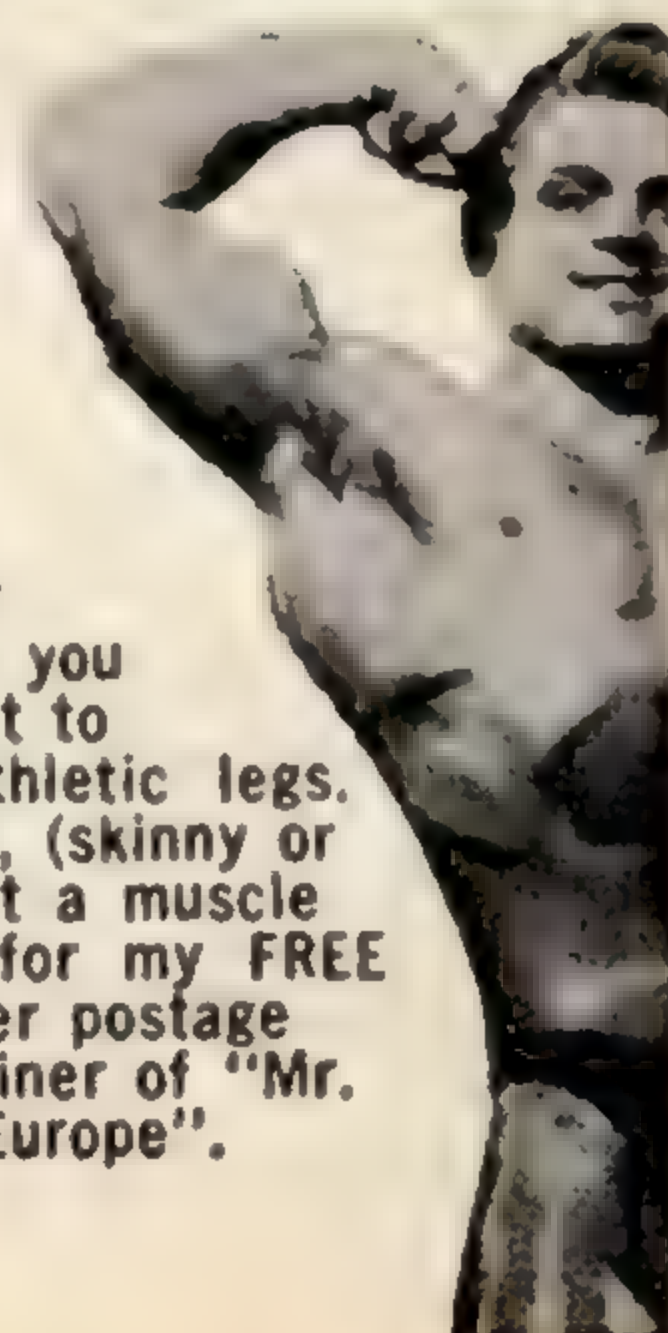
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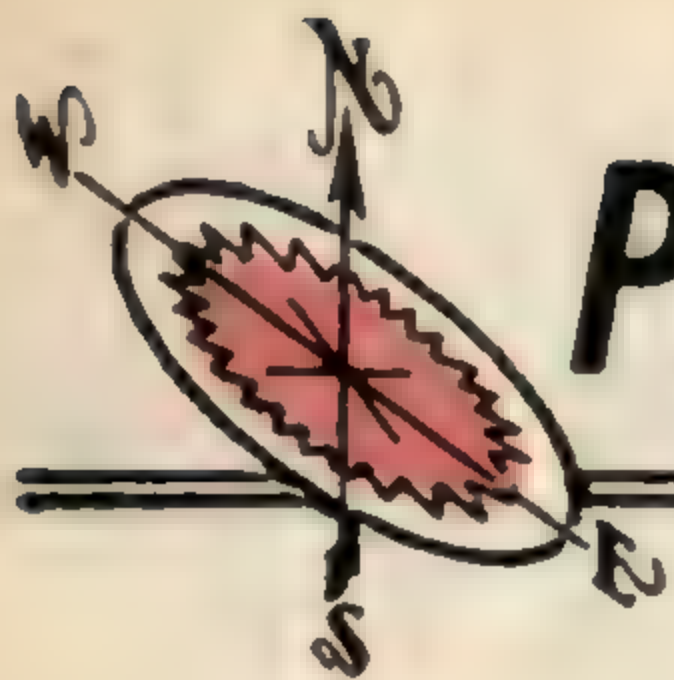
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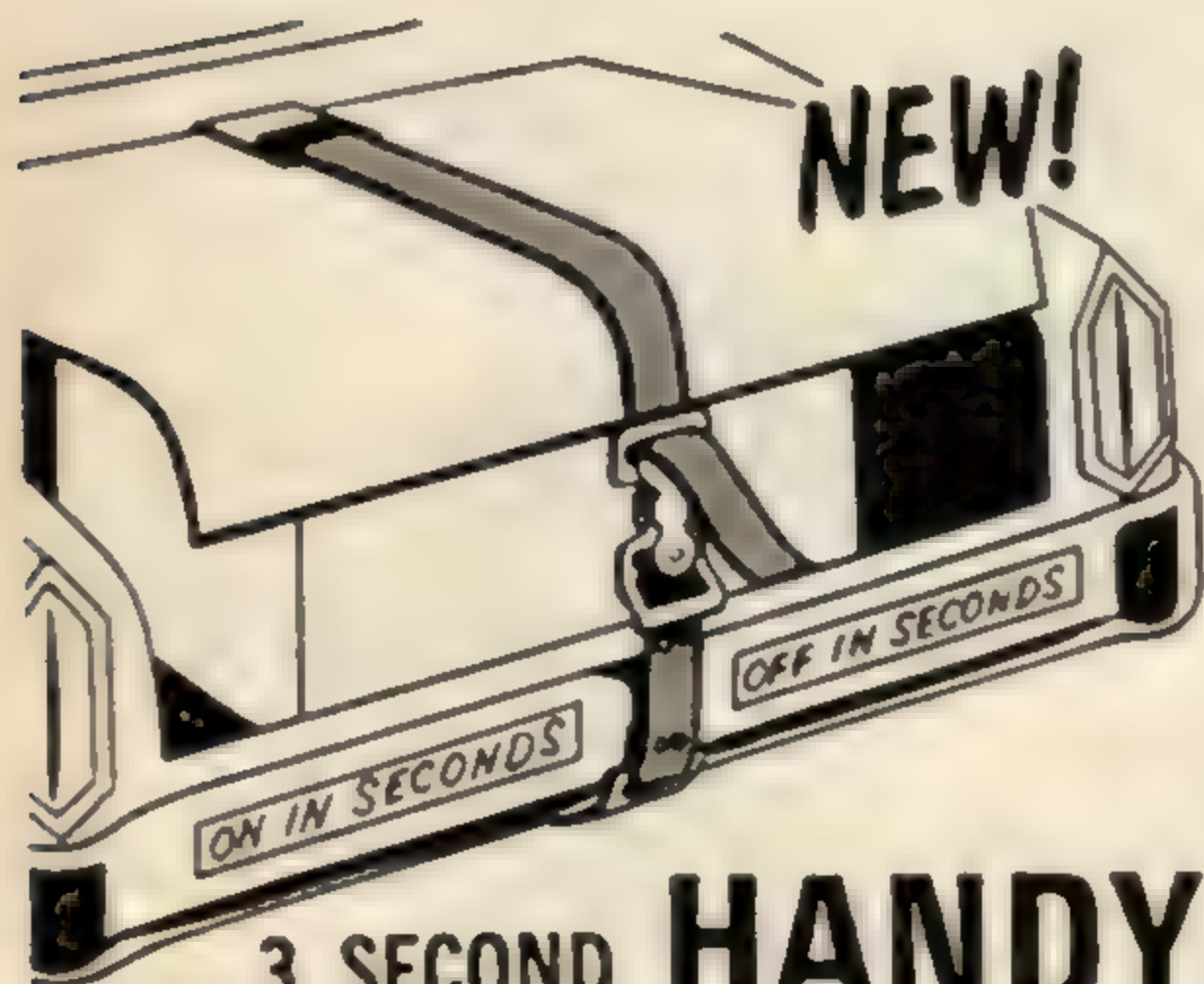
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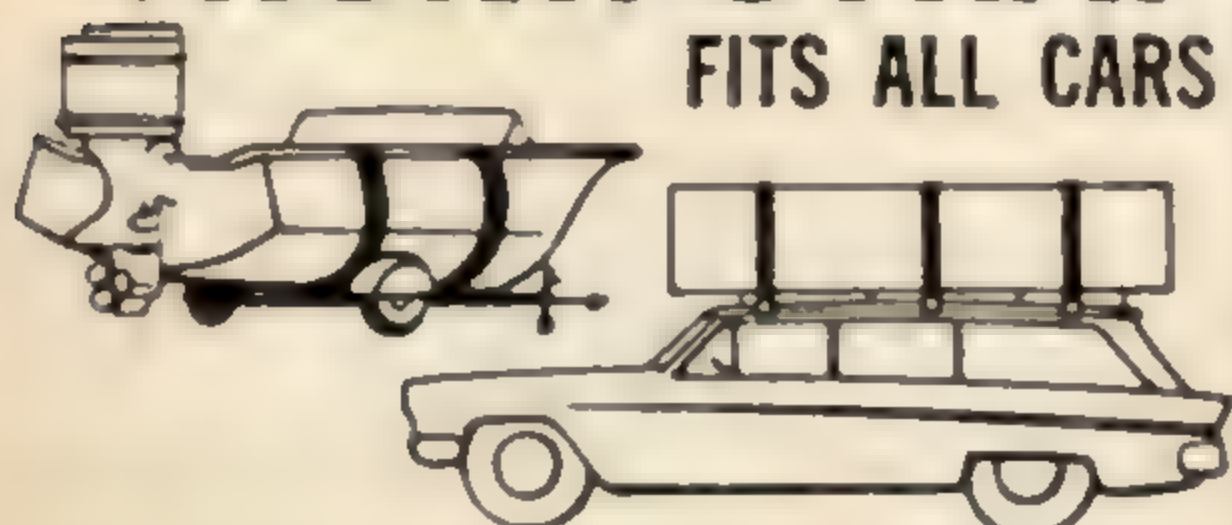


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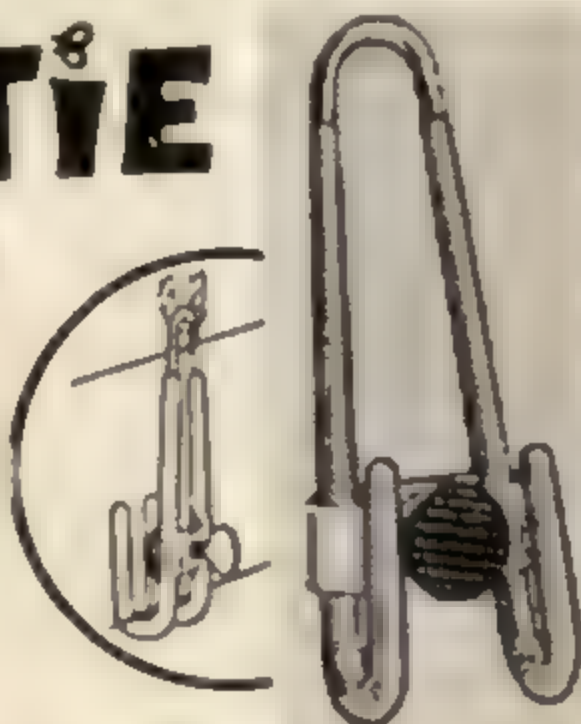
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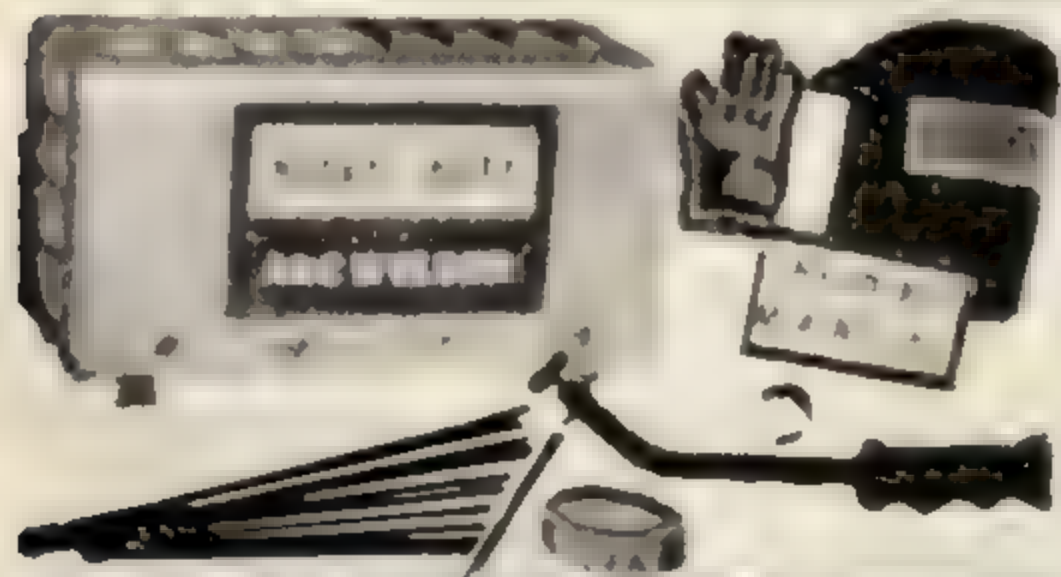
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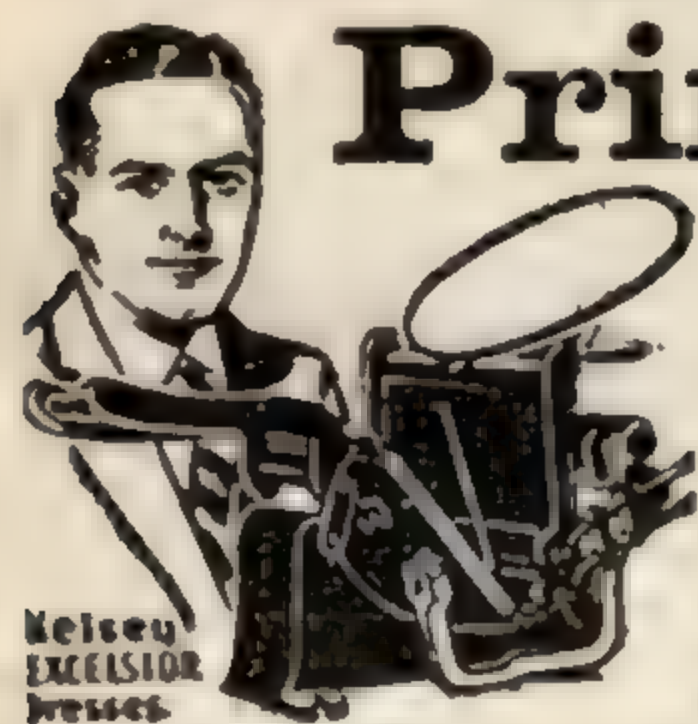
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HOME IMPORTING business. Free details. Livingston's, Box 5332, North Charleston 1, South Carolina 29406.

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EARN \$240.00 A month at home, spare time, doing only two \$5.00 invisible mending jobs a day. Big money paid for service that makes cuts, tears disappear from fabrics. Steady demand. Details free. Fabricon, 1586 Howard, Chicago 26, Ill.

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LOANS By mail, \$100-\$1000. Anywhere. Confidential. Write Union Finance, Dept. PM, 222 W. Osborne, P.O. Box 7457, Phoenix, Arizona.

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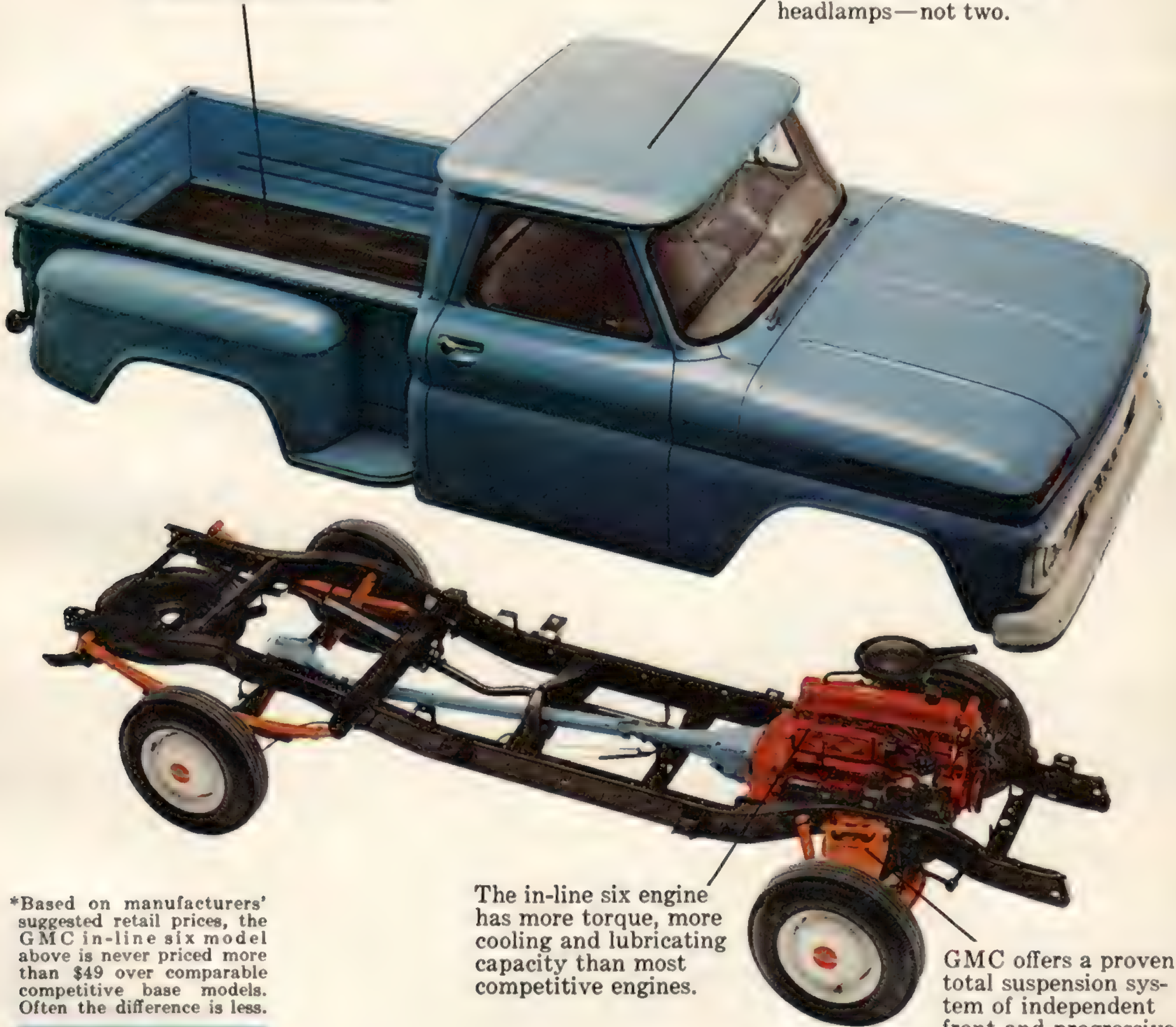
UNUSUAL! Challenging work. \$15. to \$30. per evening. No selling. Free literature. Film Service, Box 335, Goshen, Indiana.

SEND Us wool for blankets. Free Literature, El Dorado Woolens, Eldorado, Texas.

The price of this GMC pickup is \$49* more than others. (But don't raise the roof. Let us.)

A husky wood floor that is quiet and long lasting. None of that annoying drumming and rusting.

Two walls of steel and a thick pad of insulation keep the GMC cab strong, quiet, comfortable. Four headlamps—not two.



*Based on manufacturers' suggested retail prices, the GMC in-line six model above is never priced more than \$49 over comparable base models. Often the difference is less.

The in-line six engine has more torque, more cooling and lubricating capacity than most competitive engines.

GMC offers a proven total suspension system of independent front and progressive leaf rear springs. Result? Always a smooth ride even with maximum loads.

Three letters that stand for three important things. Built by truck people. Sold by truck people. Serviced by truck people.



There now. Worth every penny?

Miller High Life

The Champagne of Bottle Beer

Sparkling...
flavorful...
distinctive!



The perfect refreshment to satisfy your thirst
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Enjoy Miller High Life... on draught, in cans
and in the familiar, crystal clear bottles.

Brewed only in Milwaukee
for 110 years

Pie-Plate 'Weatherman'

A small black disc predicts weeks ahead when a farm's crops will ripen. It's also solving weather mysteries

By Clifford B. Hicks

IT'S DECEPTIVELY SIMPLE—a disc about a foot in diameter weighing less than five ounces. It costs less than \$30. Yet when properly used it can:

- Predict weeks in advance the time when a field of peas or corn—or any given crop—will be ripe.
- Help predict weather on a worldwide scale.
- Detect a forest fire 100 miles away.
- Forecast fog and frost hours in advance.

The instrument, called a radiometer, measures infrared radiation. The Weather Bureau now is using it in worldwide atmospheric research. Emerging nations, strapped for funds, are ordering radiometers by

RADIOMETER is checked by co-inventor, Dr. Pete Kuhn. Another of the remarkable little devices is about to be launched (left) to measure radiation. Instrument package is tracked by radar



the scores because the little instruments can put them smack in the middle of basic scientific research for an incredibly small investment. Major canning companies are using radiometers as prophets in the pea patch to save thousands of dollars annually.

Radiometers are not new instruments. They have been used for generations in scientific research. Today a radiometer is the searching, heat-sensing eye that guides a missile straight up an enemy jet's tailpipe.

However, sensitive radiometers were extremely costly—until two young University of Wisconsin scientists needed an inexpensive instrument for experiments. Dr. V. E. Suomi and Dr. Pete Kuhn invented one that far exceeded anyone's expectations. They took their highly accurate unit to the Johnson Service Co., a longtime maker of sensing instruments.

Simple Construction Belies Use

Johnson engineers refined the design so it could be produced inexpensively. The final radiometer looks so simple it is difficult to believe that it can be so versatile and valuable. Its outer frame, of foam plastic, is about the size of a Salvation Army tambourine. Across the top and bottom faces of this disc are windows of transparent plastic. Behind each window is an aluminum plate coated with flat black paint. Radiant energy from the sun or other heat source passes through the windows, raising the temperature of the black plate. Thermistors attached to the plate translate temperature into electrical energy, which is metered to provide readings.

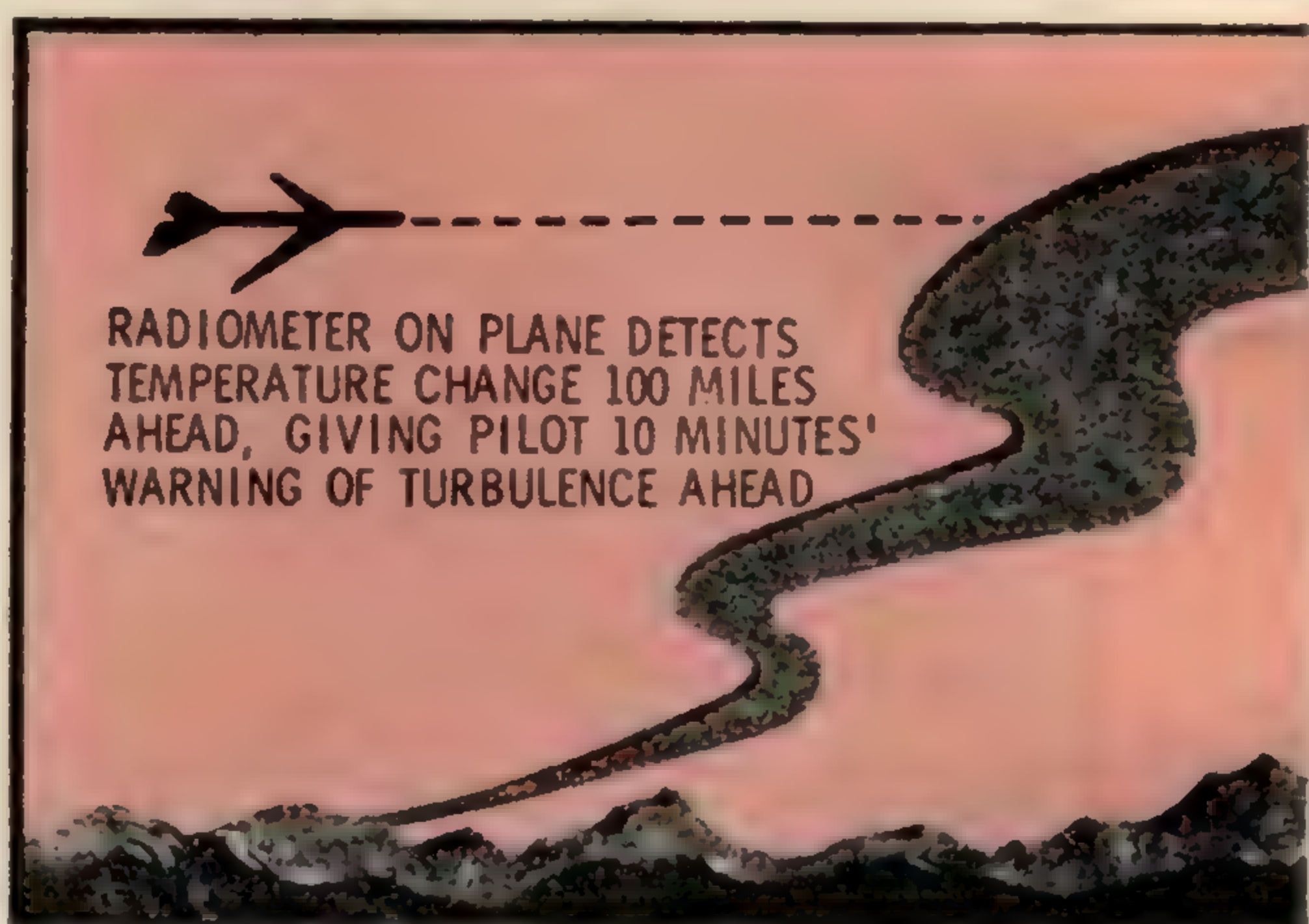
The surprising thing about the foam-plastic tambourine is its incredible sensitivity. The radiometer can detect a temperature change of 1° F. at a range of 100 miles. If your eyes were as sensitive, you not only could see a 100-watt bulb 200 miles away, but *could detect a 5-watt drop in the light level.*

This incredible sensitivity is built into an instrument so inexpensive any farmer can afford one, so cheap it can be sent into the atmosphere as the tail on a weather balloon, with no concern for recovery. Right now, the Tiros weather satellite is whirling around the Earth toting a slightly refined version of the radiometer, which transmits data on radiation in outer space.

Even more spectacular is its value in our agricultural "pea patch." Today a cannery representative, armed with data



AWAY SHE GOES! "Pie plate" is suspended well below balloon so that its receptive black eye will be fully exposed to the radiant energy from the sky

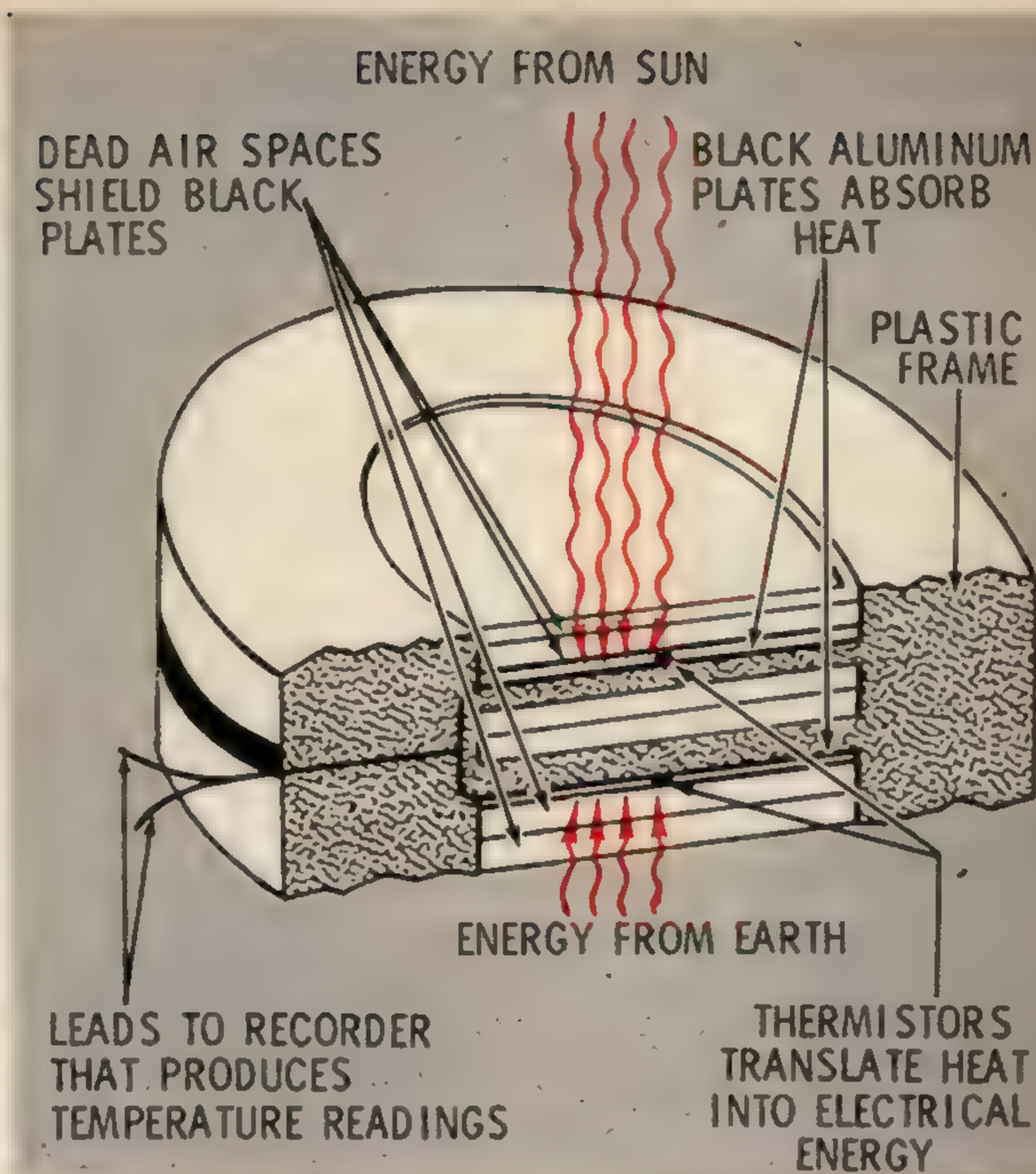


from a radiometer, can phone a farmer and say, "You know that 200 acres of peas you planted for us? Well, they'll be ready to harvest in six weeks and you can count on a yield of about 3000 pounds per acre. Your peas will run 95 percent fancy in quality if your rainfall holds to the seasonal average between now and harvest."

Such predictions are possible as a result of experiments with the radiometer, associated with standard weather instruments including rain gauges, thermometers and dew-point sensors. The research project is the joint effort of the University of Wis-



INSTRUMENT PACKAGE is tied to parachute before launching. About 50 percent of the packages are found undamaged and are returned to researchers



COSTING UNDER \$30, the radiometer is a gem of simplicity. Two inches thick and 12 in diameter, it weighs barely more than four packs of cigarettes

CAT—CLEAR AIR TURBULENCE—has been responsible for aircraft accidents and is a hazard in mid-air refueling operations. Radiometers may be used to detect CAT, which is associated with atmospheric temperature changes



consin and the Wisconsin Cannery Association. Dr. Jen Yu Wang, assistant professor of meteorology coordinating this work, has been able to predict with accuracy the yield of a pea field at 2100 pounds per acre *at the moment the peas poked their first shoots through the ground.*

All growing things react with great sensitivity to their radiation environment, which the radiometer measures. Installed on a pole near a field, it looks at the sky through one window to measure incoming radiation, looks at the earth through the other window to measure outgoing radia-

tion. Difference in the measurements is the net radiation available to plants in the field.

This radiation has particularly profound effects at specific moments in plant life, particularly at the time of planting, of germination and of first emergence. Every living plant has a sort of built-in alarm clock that starts ticking at the moment of planting, with the alarm set to go off when it is ripe for harvest. Early in the plant's life cycle, at especially critical moments, the amount of radiation it receives will reset the clock. By determining the radia-



tion so received a farmer or canner can determine, accurately, many weeks in advance, the exact day the alarm will go off.

"The first few weeks in the life of any plant," says Dr. Wang, "are crucial and immensely revealing as far as development is concerned. They supply a whole catalog of facts about the plant: its rate of growth, reaction to environment, capacity for survival. Once these facts are known, the plant's performance throughout its life cycle can be, in most instances, predicted with more than reasonable accuracy."

Surprisingly, weather in later stages of a plant's life has little effect on the *rate* of development. A long, dry spell affects crop quality and quantity, but has almost no effect in resetting the alarm.

Canners Can Cut Waste

A network of 100 stations, using Suomi-Kuhn radiometers and other instruments, has already been set up in the North Central states, primarily for canners. Armed with specific information from these instruments, farmers arrange well in advance for the work crews necessary on harvest day. To the canner, gross overstocking or understocking of salt, sugar, starch and cans is a thing of the past.

Furthermore, because early radiation is a factor affecting quality and quantity, the canner can make a reasonably accurate estimate of them weeks in advance. The estimate may require revision due to drought or flooding but it is much more accurate than past guesses.

The program has been so successful that Dr. Wang predicts, "Every farmer in the near future will undoubtedly use some form of radiation instrument in his fields."

The radiometer promises to be as valuable in weather research. For centuries, meteorologists have had to rely on fairly simple and scattered weather observations. Location and direction of frontal systems, speed and direction of winds, temperature of the air—these were factors used in their predictions. They have come to realize that these factors and many others depend upon the shower of energy from the sun. A vast dynamo hangs out there in space, pumping an incredible supply of energy to the Earth. This radiant energy sets in

(Please turn to page 210)

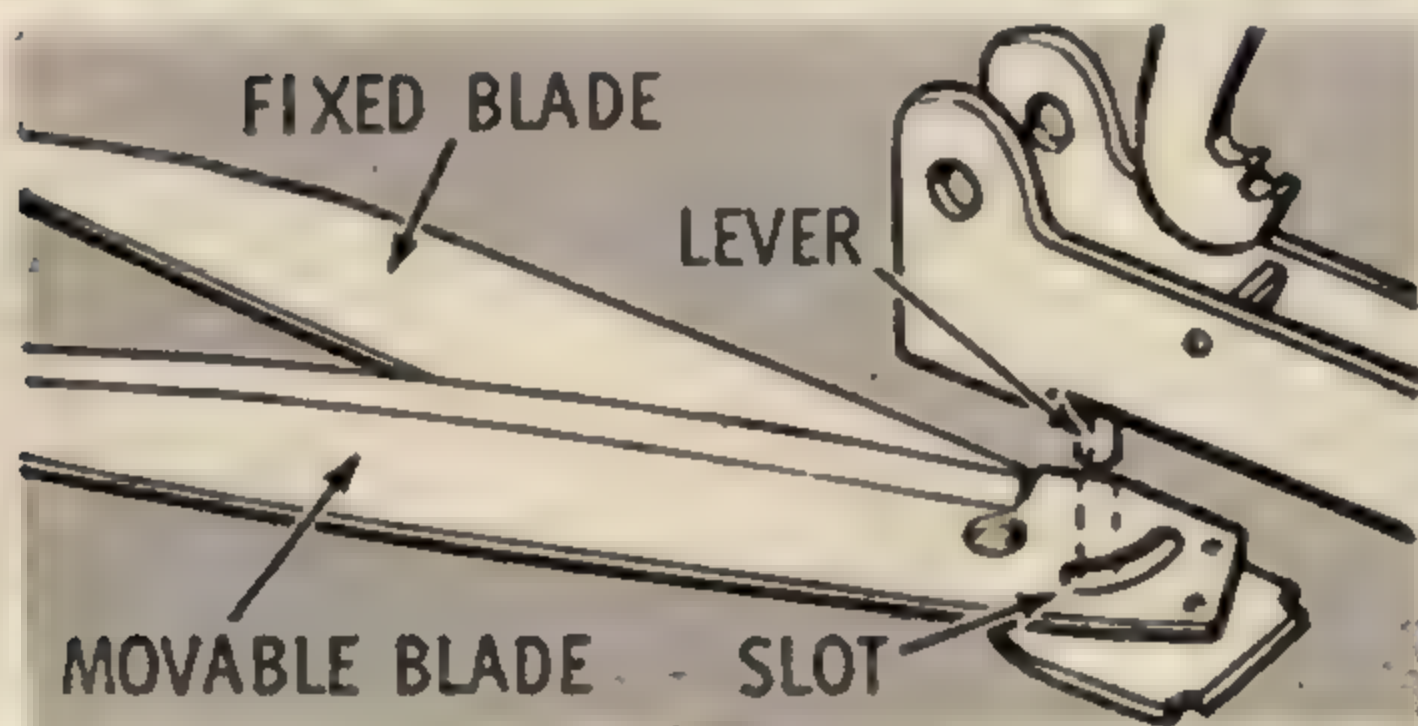
INSTALLED IN FARMER'S field, radiometer is backed up by more conventional weather instruments, which indicate wind velocity, humidity and temperature

Gearshift Clippers

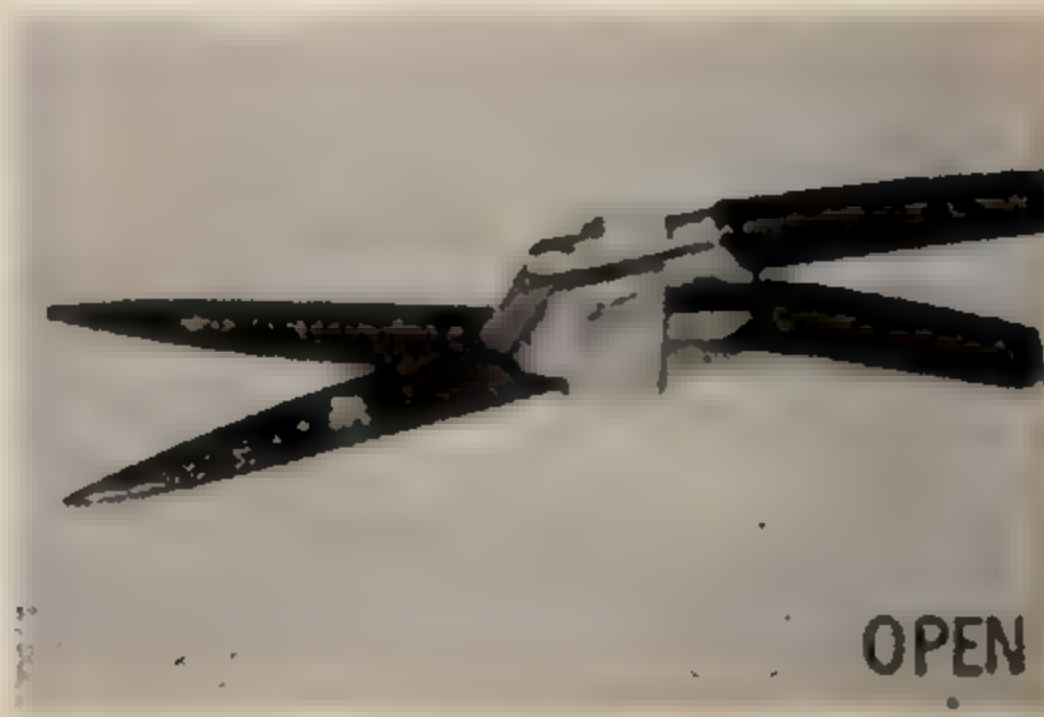
Three-position setting on new grass shears enables them to be locked for storage, set half-open (for fast clipping), or full-open. "Floating fulcrum" (below) reduces cutting effort, says the maker, Melnor Industries. With stainless steel blades, price is \$4.98.



LOCKED



HALF-OPEN



OPEN



Tach Shows Torque Curve

This two-way tachometer has a built-in "window" on the dial with a torque curve that can be set for most engines. This allows the driver to shift for maximum efficiency or maximum performance. PM mounted one on a test car and found it accurate to slightly less than two percent. Available from the Sparkomatic Corp. of Milford, Pa., the Twin Tach is priced at \$29.95.

Vacuum-Packed Pilot

Navy pilots may soon be wearing a new, tight-seal design helmet. Its built-in breathing system features a tight seal around the face with only the space between the face and the visor used as the breathing cavity.

The visor has its own de-fogging and ducting system for cooling. A tinted sun shade can be quickly adjusted to any position. The helmet has a built-in microphone, weighs four pounds, protects up to 50,000 feet.



WORLD'S FASTEST dragster, Don Garlits' "Wynn's Jammer," screeches away from starting line, smoke billowing from scorched tires, just about obscuring driver. When accelerating, dragster is almost floating on liquid rubber



Here's How I Win Drag

Top eliminator in national hot-rod races and first to crack 200 mph in the quarter mile, shares his winning secrets

BLASTING DOWN the drag strip in a cloud of smoke sounds like a daredevil sport but it's the conservative drivers who win.

I ought to know. I've won plenty of drag races, mainly because of the precautions I take. When you're driving at the edge of catastrophe you can't take chances.

My safety precautions start when I'm dressing. I put on an aluminized fire suit and fire boots because the flames will blow back into the cockpit if the engine catches fire. That hap-

pened twice and I was hospitalized each time.

I push heavy ear plugs into my ears, because I'll be sitting within a couple of feet of eight exhaust stacks that pour out more than a hundred decibels of sound. I clamp a wet rag between my teeth, then pull on my aluminized face mask and built-in goggles.

I'll breathe through the wet rag until the race starts. The water in the rag has an affinity for nitro and soaks it up. This helps keep me from being poisoned by the unburned nitro fumes that blow back from the exhaust stacks while the engine is idling.

My crash helmet goes on next, especially padded to protect my head against the battering it receives from the roll bar. Last of all I put on the



Races

By Don Garlits

aluminized fire gloves.

One thing I have to be careful about in reaching a terminal velocity of more than 200 mph at the end of the quarter mile is to keep the engine from blowing up. I drive a 1957 Dodge hemi truck engine that originally rated at 345 hp. But with aluminum pistons and connecting rods, other engine changes, a supercharger and a fuel that is mainly nitromethane I get an estimated 1200 hp plus at 7500 rpm. I say "estimated" because the engine wouldn't stay together long enough to steady the needle if it was revved up on a dynamometer.

The powerplant is designed for no more than nine seconds of operation at full power. It would explode if accelerated another eighth of a mile past the timing trap. I've blown up more than

THE AUTHOR, dressed for race, looks like creature from outer space. Aluminized gloves, face mask and fire suit protect him in case engine catches fire



25 supercharged engines on the strips in the last seven or eight years.

Coming up to the starting line, with my left foot holding down the heavy clutch that can handle 1700 hp, I keep my eyes on the electronic timing stand. If it's a "Christmas tree" with lamps that blink on half-second intervals, I go through my own mental countdown. I put the throttle all the way to the wood and let off the clutch and hand brake when the green light is due.

But if the starting system has a random delay of up to a second and a half, a mental countdown is dangerous. I watch and wait, and depend on a better-than-average reaction time to get away.

Getting away in a hurry calls for precise handling of the throttle, clutch and brake.

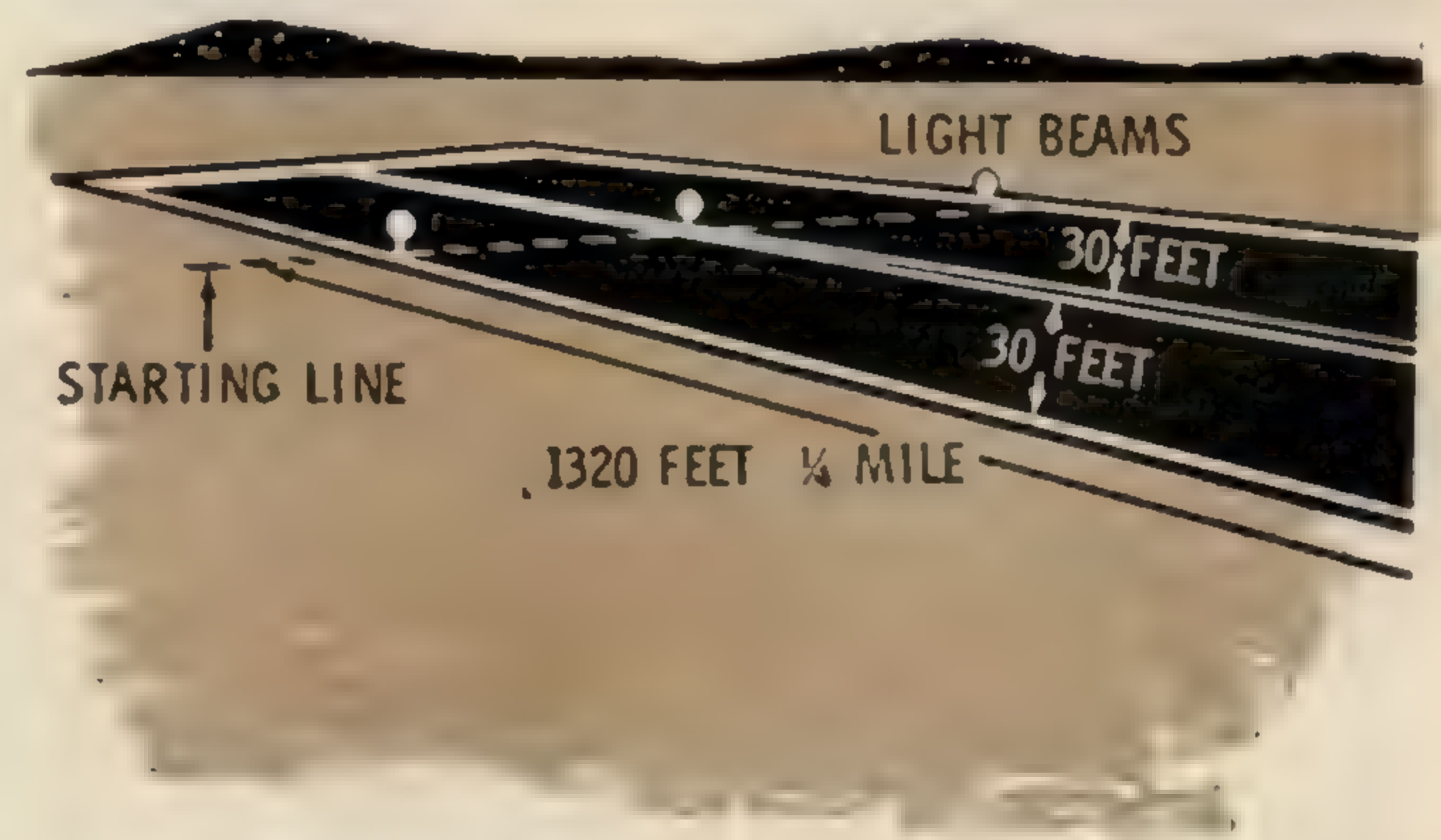
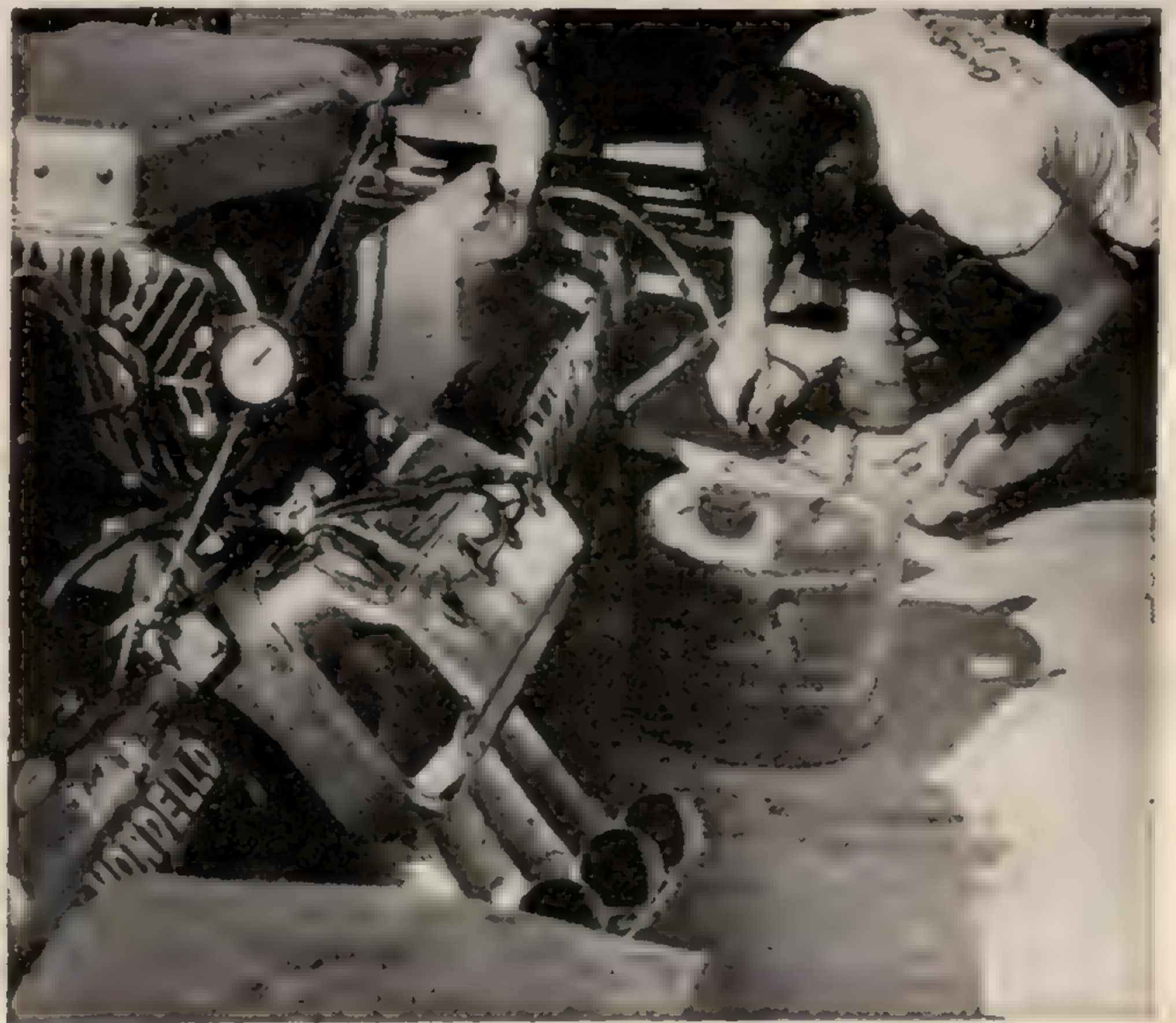
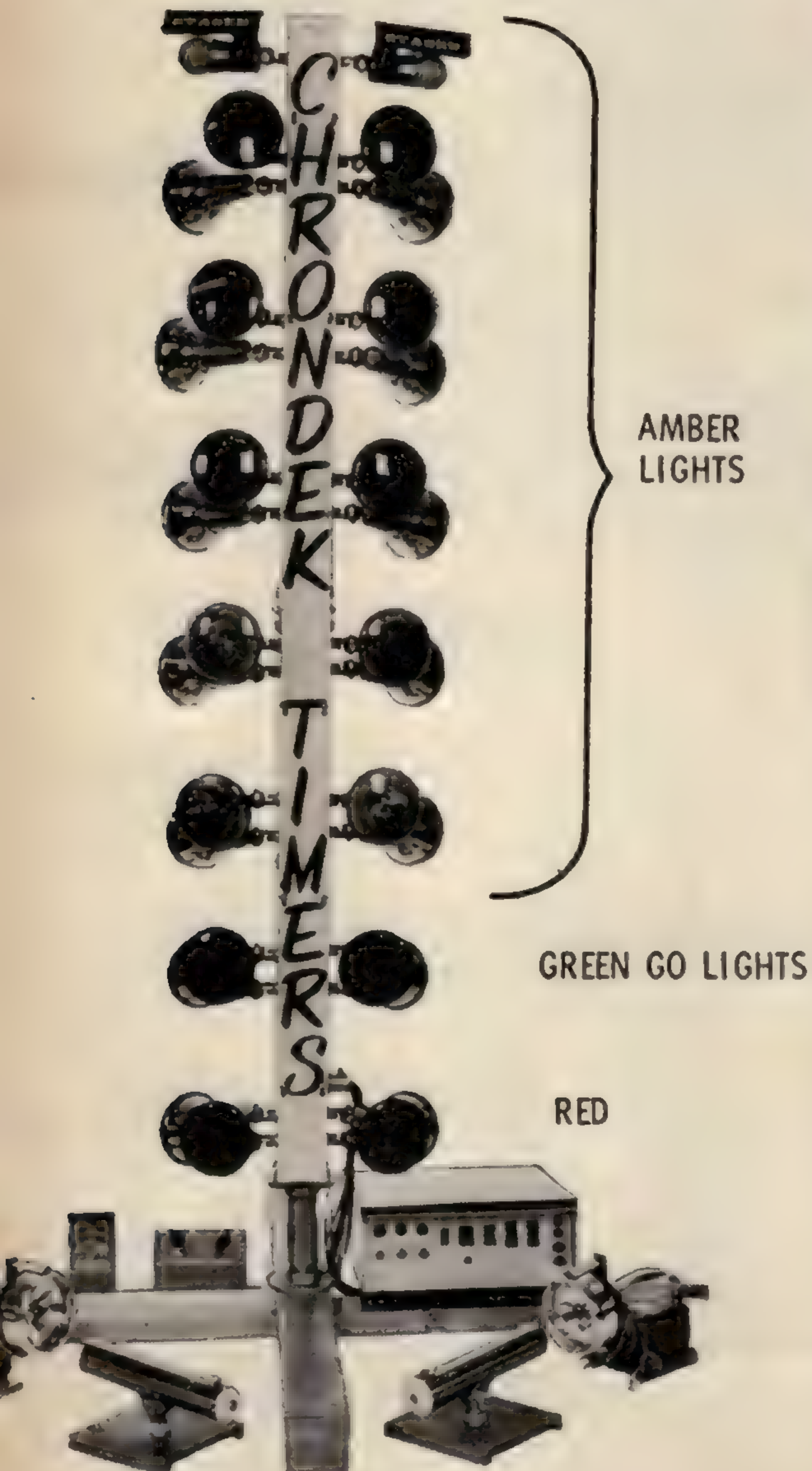
"CHRISTMAS TREE" stand starts dragsters. Five pairs of amber lights start flashing down from top to green "go" lights. Bottom red lights flash fouls

If I let the clutch in too slowly I'll be left behind; if I let it in too fast I'll do a wheel stand and sit there smoking. The flat, 11-inch-wide dragster tires are going to smoke anyway, and even with a good start the smoke is blinding.

At this point the tires are spinning so fast they are actually burning. That's what causes the smoke. They are so hot that the vehicle is traveling on a thin film of liquid rubber. That's why the car feels like it's skating on ice for the first 150 feet or so.

The car accelerates at a constant rate of better than one G and this keeps me pinned against the seat. I'm sitting behind the differential, with the backs of my knees resting on the axle housing. By now the tires, still smoking, are starting to grow

EXOTIC FUEL is siphoned by Garlits into graduate to measure its specific gravity with hydrometer. It indicates whether mixture needs slight adjustments



DRAG-STRIP LAYOUT measures 1320 feet (quarter mile) plus 2200-foot minimum overrun. Electronic timing with light beams and clocks gives elapsed time and miles-per-hour at finish. Lanes are 30 feet wide

from centrifugal force. They'll expand a full two inches in diameter in seconds.

By now, too, the front end is becoming a little light and the steering isn't as responsive as it was. There's a deflector plate in front that's designed to hold down the front end by air pressure, and this helps compensate for the loss of weight of the fuel in the tank just behind the front axle. The engine consumes more than two gallons of fuel in less than eight seconds. It sprays into the supercharger at a rate faster than that of a big showerhead.

About five seconds after take-off I've reached the halfway point and now I make my "go or no go" decision. If I'm lined up with the timing trap I keep going. If I'm not lined up at this point there's a good

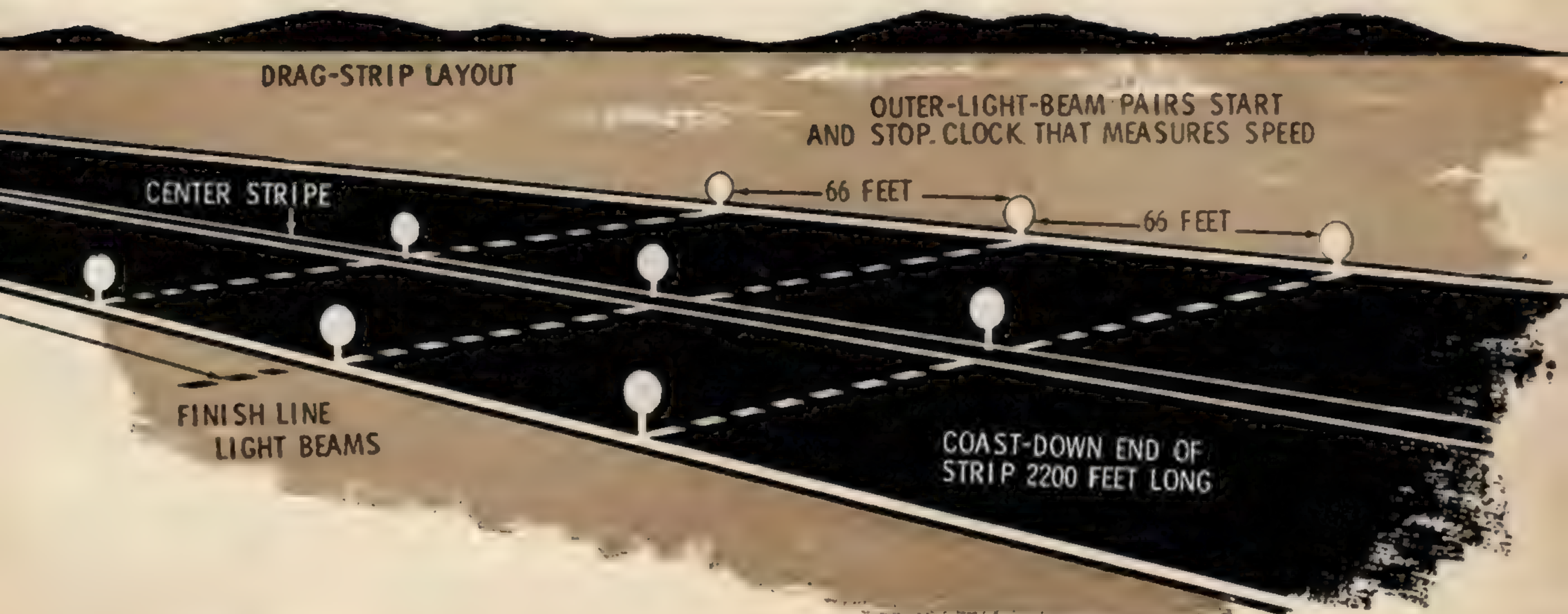
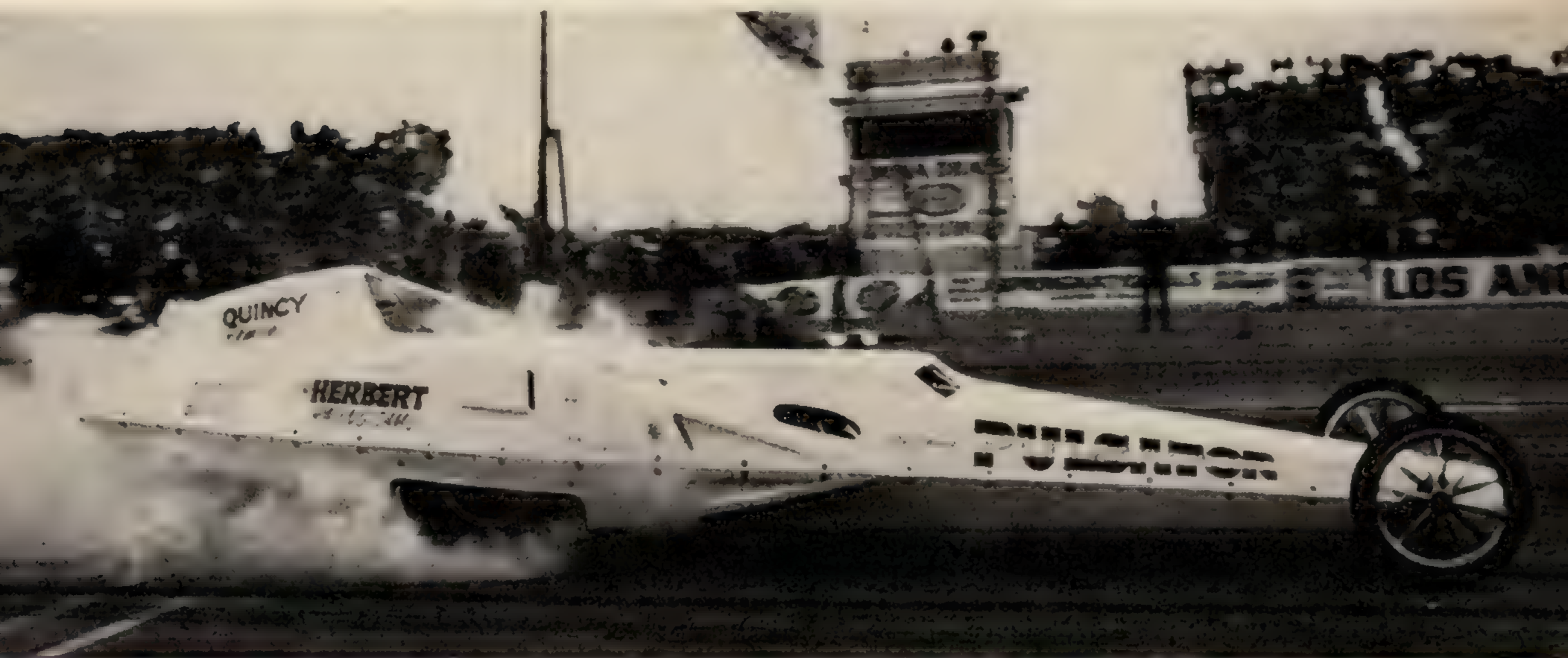
chance I'll drive off the strip in the next second. I back off the throttle just a little to put more weight on the front wheels and allow them to steer better. I'll back off all the way if I have to, though this usually means I've lost the race.

A driver who backs off to about half-throttle at this point and then stands on it again is likely to blow his supercharger 50 feet in the air.

Hitting the Chute

As soon as I'm past the halfway point I grab the chute release in my right hand because the engine is now attaining maximum rpm and on the ragged edge of disintegrating. I'll want to stop in a hurry if it does. If nothing happens, I hang onto the

STREAMLINED BODIES, which aid acceleration and also direct tire smoke away from driver's vision, are latest trend in dragster design. Note the enclosed cockpit and covered engine. Garlits' engine and cockpit are open





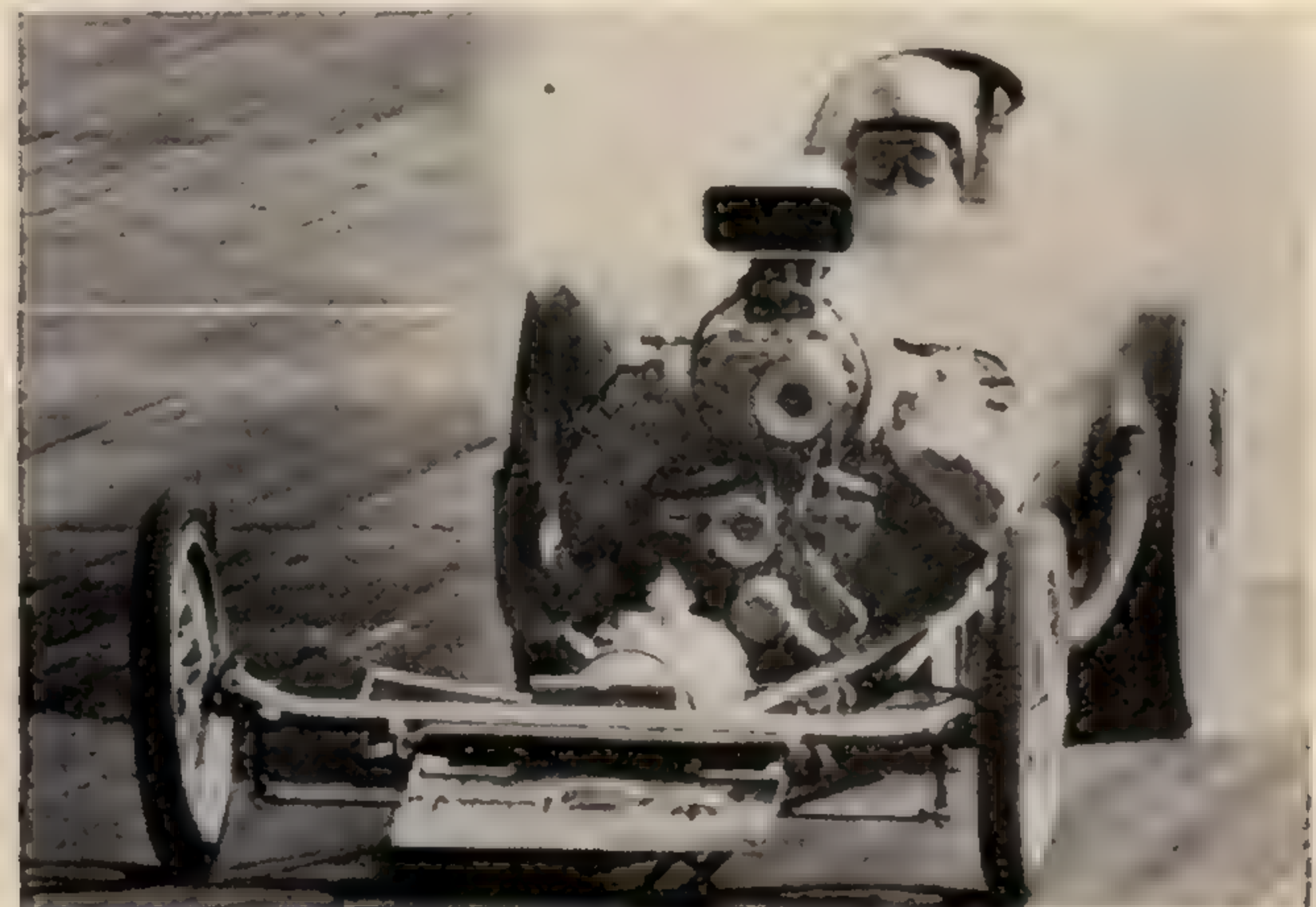
DRAG RACING has six main class brackets, from super-tuned stock cars to unlimited "slingshots." This is "AA altered" dragster with supercharged engine



DRAG CHUTE is main deceleration device for unlimited dragsters. Its 4.5-G surge throws driver up against shoulder harness when it first pops open



STOCK CAR lifts front wheels as it accelerates away from starting line. Aside from super-tuning of engines, stock cars must race pretty much "as is"



JACK WILLIAMS, 1964 National Hot Rod Assn. points champion, aims his unlimited-class dragster down strip. There are about 325 strips in the country now

release through the timing trap and then yank open the chute. I take my foot off the throttle, shut off the fuel and brace myself against the four-and-a-half-G shock of the chute's opening.

In one race last year when I had a 16-foot diameter chute, I was thrown forward against the safety harness so hard that four of my vertebrae were crushed. This year I'm using a 14-foot chute.

When I pull the chute release I instantly drop my hand to the brake, ready to drag it back if the chute doesn't grab. This happens about once a year. A lot of dragsters have crashed at the far end of the shutoff area because they didn't get on the brake fast enough when the chute didn't open.

Post-Run Checks

My precautions don't end when the run is over, because the engine is severely punished while it's on the strip and another run may be coming up.

We pull the spark plugs, gap and clean them, and replace any that are broken. Their condition tells whether the fuel mixture is correct and whether any rings have broken. Next we torque down all the head bolts, which had been stretched during the time the heads were trying to blow off. In turn, this calls for resetting the valve clearances. We drain the five gallons of water from the block (there's no radiator) and refill with cool water.

I give the car a general inspection and help the rest of the crew repack the parachute. Tire pressures are checked—20 pounds in the rear, 40 pounds in front. The fuel tank is filled, possibly with a slight change in mixture. The standard fuel is about nine parts nitromethane to one part alcohol. Some drivers like to add a small dose of benzine that gives a richer mixture, a little acetone to help blend the main ingredients, or some propylene oxide be-

(Please turn to page 206)

DRIVE IT COOL

With the Right Car Airconditioner



Better-looking, space-saving, quieter units give big boost to all-year springlike comfort

By Walter O. Koehler

JIMMY, AN OTHERWISE normal California teenager, has a couple of dummy airconditioning ducts on the rear shelf of his '59 Plymouth. He's willing to ride around with the windows up—sweltering—just to make it look as if he has an airconditioned car.

Sadly, Jimmy is behind the times. Trunk-mounted cooling units may rate high as status symbols, but they're rapidly losing popularity as coolers. The big shift is to new, up-forward cooling that is remarkably trim and compact.

A few years ago, car coolers were cumbersome monsters. When you popped the hood on an airconditioned car, it looked as if machinery was about to spill out over the fenders. These days the works nestle neatly around

the engine. What's more the systems have improved vastly.

Luxury-car owners still are the big buyers, but the torrid Southwest no longer corners the market. Lincoln Continental is the industry champ with airconditioning in 85 percent of its '65 models—including three quarters of the convertibles.

If you haven't priced car airconditioners recently, you're in for a happy surprise. Original-equipment units cost from \$275.50 for a Ford Falcon to \$649.85 for the dual rig in an Imperial. Independents offer good coolers to fit almost any car for about \$300 to \$375 installed. Some independents' dealers knock off \$50 during off-season.

Besides cool comfort, airconditioning helps victims of hay fever and other allergies by trapping some airborne irritants. Passengers arrive without that windblown look. And closed windows mean less noise, less fatigue.

There are disadvantages. The compressor can cost from 3 to 12 hp, depending on speed. You may lose a mile or so per gallon. Even when the unit isn't in

use, mileage suffers because of the extra weight. The numerically higher axle ratio often furnished with airconditioning takes its toll, too.

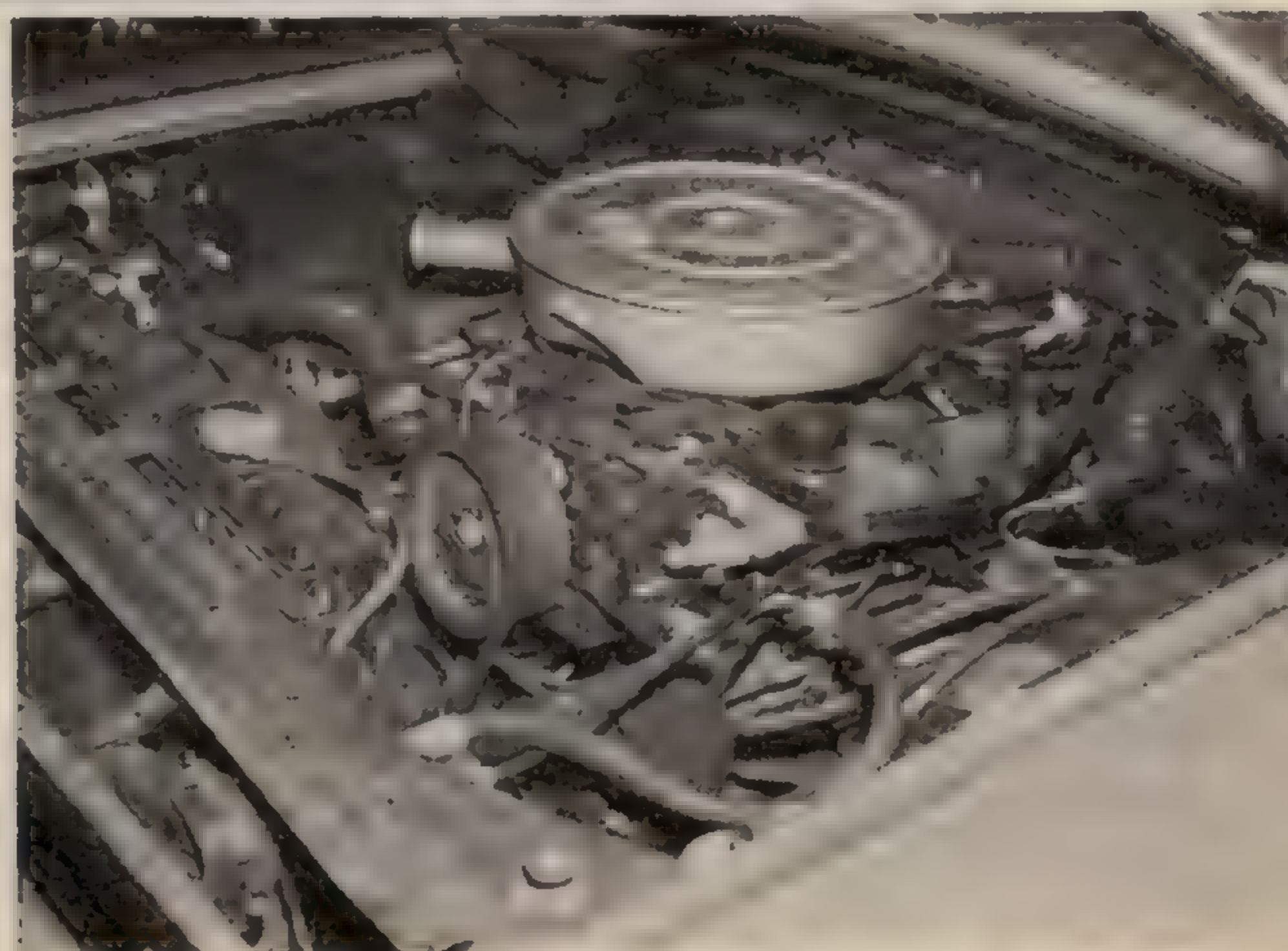
But let's assume you've weighed these factors and are still in the market. Is it best to buy factory-installed "air," to have the dealer put it in, or to shop for a hang-on model?

More Legroom for Passengers

Most factory-installed coolers are integral units that tie into the heating system and utilize the same blower and some of the ductwork. Cooling outlets, built into the instrument panel, are neat looking and out of the way of passengers' legs. They let you use recirculated air for fast cool-down or bring in fresh outside air to get rid of smoke. Control systems generally are more sophisticated (thus a little more expensive to work on) than those for hang-on units. Cadillac and Pontiac, for example, offer fully automatic temperature control; set the dial and desired temperature is held with heated or cooled (or



HIDDEN BEHIND GRILLWORK, discharge ports for Lincoln factory airconditioner are practically invisible. Car manufacturers are able to blend the cooler functions into car styling while aftermarket suppliers must tack their units on, usually hang them under the dash. At right is the neat layout under Ford's hood. Condenser coil and fins are in front of the radiator. Belt from fan shaft runs compressor



mixed) air, whichever is needed to hold the temperature selected.

Factory rigs often put the blower, sometimes even the evaporator coil, in the engine compartment for added passenger legroom, but the distance the cooled air must go and the corners it turns cut down on its velocity. Independents have to put more components in the passenger compartment, but that has the advantage of improving performance.

Dealer-installed hang-ons are less costly than factory jobs. And you often get faster new-car delivery by buying from stock and letting the dealer add the cooler. Air flow may well be better.

Aftermarket airconditioners must fit a wide variety of car makes and models. Some still lack a built-in look, but many this year are surprisingly successful in combining fine styling with compactness.

A big step forward is the new coil-fabrication system by Modine Manufacturing, Racine, Wis. After the all-aluminum coil is built up, it can be formed into a variety of shapes to fit any available

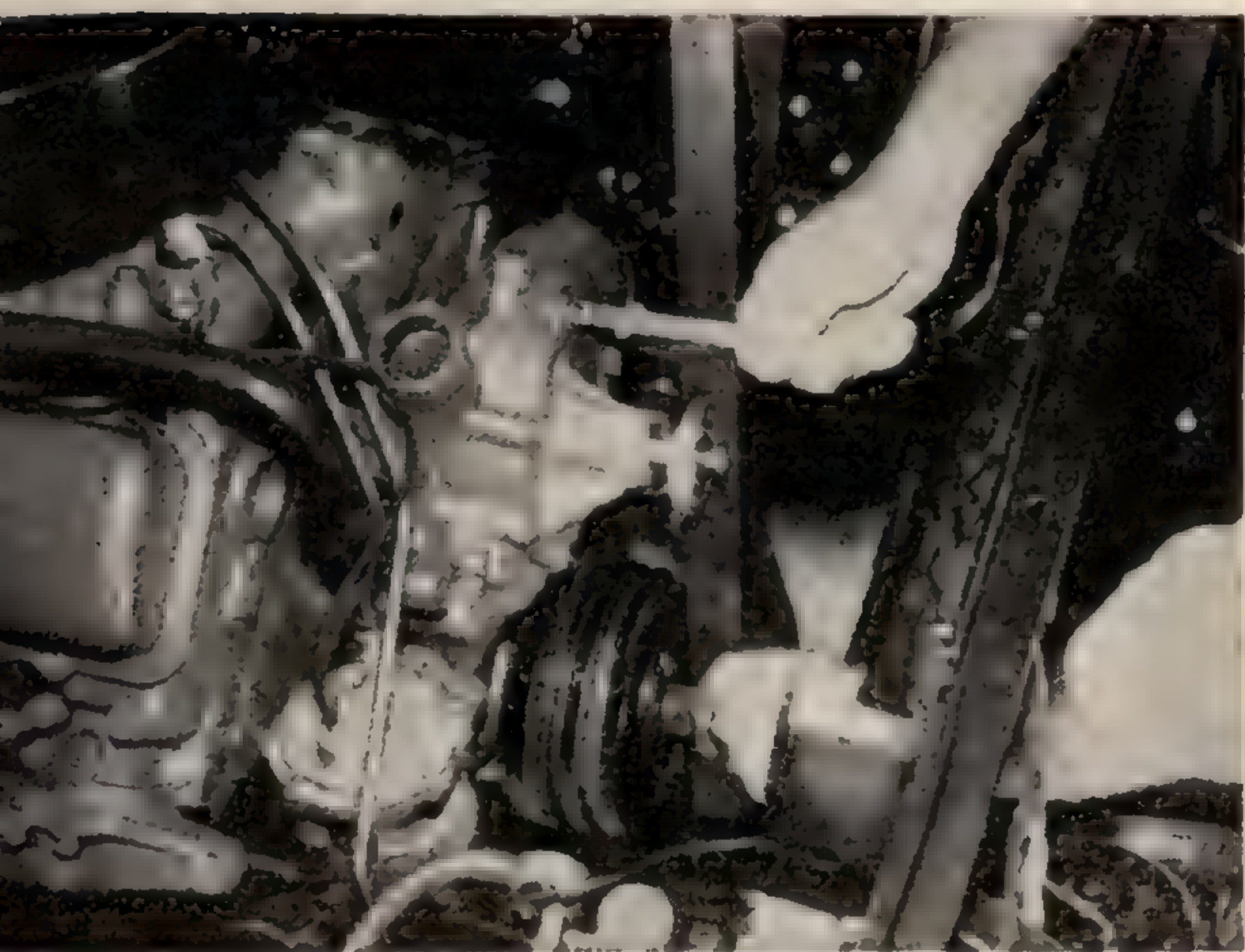
space. Normally, the evaporator coil accounts for most of the bulk protruding into the passenger compartment.

The other element shoving your feet is usually a pair of squirrel-cage blowers, one on each end of a motor shaft. But this year, Vornado, a division of Automatic Radio, has switched signals on its Slimline II under-the-dash model. Air flow comes from four small fans, all belt-driven from one motor.

Fans Save Power

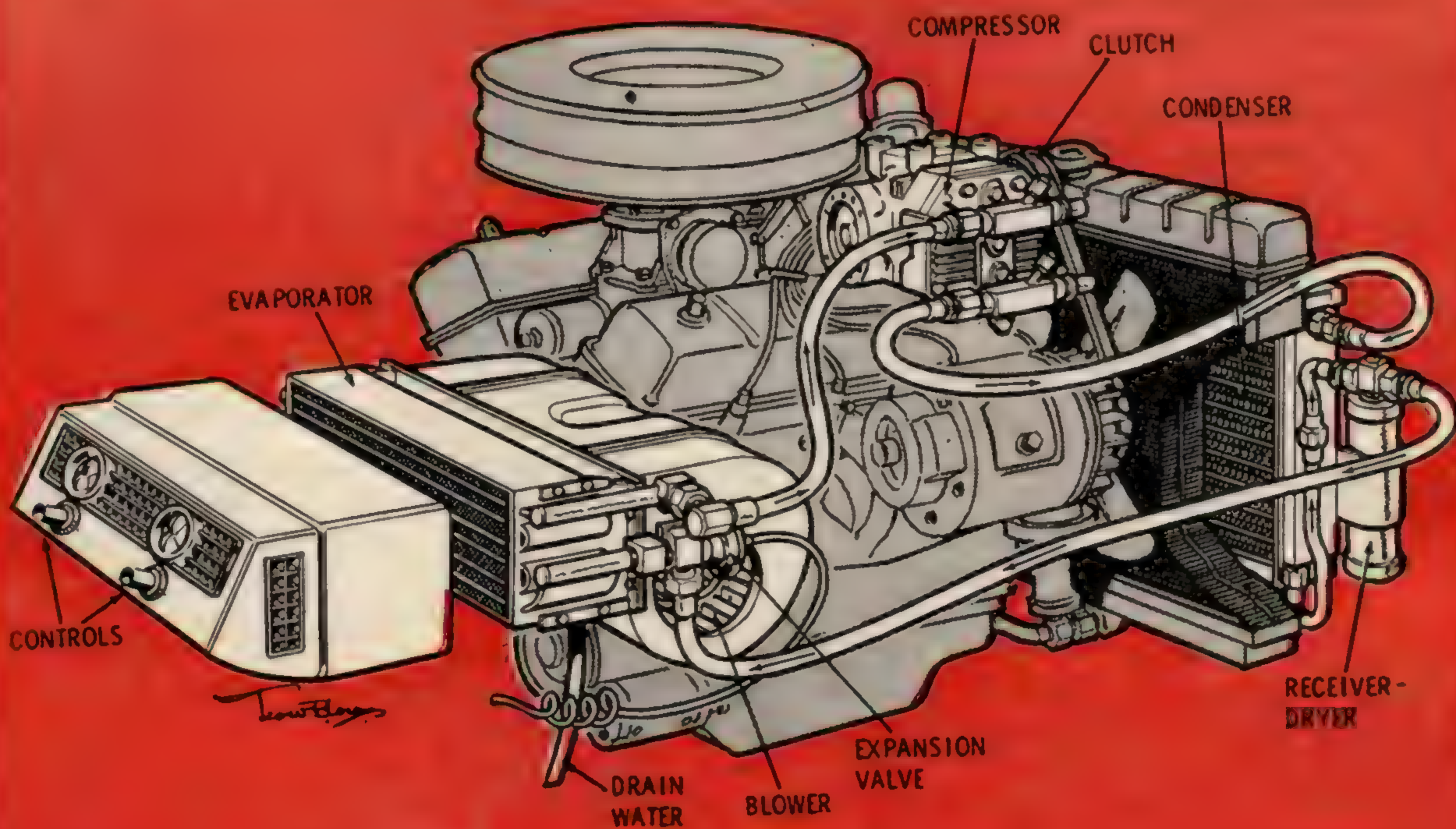
There's a solid, common-sense reason for this new interest in fans. Engineers are constantly struggling to save electricity. Fans can deliver air at about 300 cubic feet per minute (c.f.m.) using 5 or 6 amps; blowers need 7 or 8. (Fans, however, are handicapped when the air's path is restricted or tortuous.)

As independents quickly point out, their systems can usually be switched from car to car when you trade. Savvy motorists even buy hang-ons for leased cars, later switch them to new models. The swap



CAREFUL ALIGNMENT of pulleys and belts is important part of installation of hang-on units. Charging the system with refrigerant can also be a touchy business. Inside the passenger compartment, hang-ons' styling has become more harmonious, less obtrusive. The latest approach: slim units that stretch two feet or more along the lower edge of the dash. Accessibility of controls generally is good





REFRIGERATION CYCLE STARTS when the expansion valve bleeds high-pressure liquid refrigerant slowly into the evaporator coil so pressure drops sharply. In the coil, the liquid "boils" (becomes a gas) and in the process soaks up heat. The chilled coils cool the air blown across them toward you. The gas is re-compressed—squeezed so tight its temperature shoots

as high as 200° F.—and is pumped through the big condenser coil in front of the radiator. Air flowing between condenser coils takes off heat and the gas becomes liquid again, still under high pressure, then goes through the receiver-dryer where excess moisture is trapped. From there it's piped back to the expansion valve to start the cycle all over again

usually costs about \$75 if you stick to the same make. Otherwise you may have to add \$40 or so for new "plumbing" and hardware.

All refrigeration units, whether parked in your kitchen or zooming along the highway, work similarly. They soak up heat from a closed compartment—in this case, the passenger space—and release it outside. Take away heat and what's left is cold (see cycle sketch above). But there are special headaches with car coolers.

The toughest nut is born of the unhandy relationship between engine speed and cooling requirements. When the car is chewing up the turnpike at high speed, great gobs of air pour through the coils, carrying off heat; compressor, fan, water pump and alternator spin at a merry rate. The compressor does its best work when it's needed least.

But when the car crawls through city traffic, sun beating through panoramic windows and heat glaring from blistering pavement, the engine is barely turning over. The compressor is loafing, the alter-

nator is hard pressed to answer electrical demands from blowers, radio and ignition. At this speed the engine needs all the cooling it can get without the handicap of the condenser sitting in front of the radiator.

Factory-Built Advantages

Factory-installed systems start with a definite edge, since many problems can be solved as the car is built.

Most car makers offer rear axles of higher numerical ratio as part of an air-conditioner package or as a recommended option. This means the engine turns faster for a given road speed. Compressor, fan, water pump and alternator also spin faster. And the gearing compensates for the weight and power consumption of the cooler. Thus you get the same acceleration as the poor soul who drives around with the windows open.

While cooling the car's interior, the air-conditioner throws an extra load on the engine cooling system, raising underhood temperatures. The main culprit is the big condenser coil, which blocks some air from

the radiator and feeds it with heat pulled out of the passenger compartment. To avoid engine overheating on airconditioned models, most car makers provide extra-capacity radiators. Rambler Ambassador's has more tubes and fins for more heat transfer surface. Pressure caps are set higher so coolant can get hotter without boiling. Heavy duty (HD) fans with extra blades, greater diameter or both boost air flow through the condenser *and* radiator.

The HD fan has one drawback: It works full time, needed or not. In the winter it's still flailing away, doing its best to keep the engine from warming up (and raising the noise level). Thermal control on the fan is possible, but costly. Pontiac's treatment is typical: A thermostatic clutch disengages when air comes through the radiator at less than 150° F., limiting fan speed to 1400 rpm. Higher temperatures re-engage the clutch but, since torque capacity is limited, it begins to slip at 2200 rpm. That keeps the fan from overspeeding at turnpike speeds—when it's about as useful as a secondhand soda straw. Hang-on manufacturers and mail-order houses offer such fans, too.

Early this summer, Ford announced a still simpler solution—flexible fan blades. As a running change, the thermostatic-clutch fan for airconditioned cars has been replaced by a five-blade model in which the centrifugal force of higher speeds tends to flatten the blades. They bite into the airstream less, thus consume less power.

Special fan shrouds, air seals between the hood and radiator support, and high-output water pumps are other solutions.

Licking Vapor Lock

More than the cooling system is affected. Baking underhood temperatures threaten vapor lock percolation and other fuel problems. One remedy popular in Detroit

FLEXIBILITY OF DESIGN is one advantage of the new Alfuse aluminum coil. Manufacturers can torture the serpentine coil into a variety of wild shapes



is a fuel vapor return line from the fuel filter or pump back to the tank. It assures a supply of liquid gasoline for the engine.

Even power steering can suffer from underhood heat. To guard against seal damage and leaking or bubbling fluid, Chrysler adds oil coolers for power steering on some airconditioned cars.

To let the cooler's compressor work its little heart out while fan, water pump and alternator turn fast enough to earn their keep in traffic, most factory-airconditioned GM cars and Lincoln Continentals get an idle speed-up device. With cooler operating, this gadget comes into play as you put the transmission in Neutral. Raising idle speed higher than the usual 500 rpm keeps the engine from stalling under the heavy airconditioning load. Inadequate condenser capacity causes back pressure against the compressor under such loads and can also cause squealing protest from slipping belts while you wait at a stop light.

Often a high-output alternator and a heavy-duty battery are included with factory airconditioning.

With all the iron of most systems at the front of the car, basic nose-heaviness is exaggerated. Thus, some car makers include oversize tires in airconditioning packages; others make them mandatory options and charge extra; a few merely recommend their use. In a few cases, heavier front springs are installed.

Car tests have pointed to some improvements. Standard procedure is to let a car "soak" in the sun for an hour with windows closed. Within minutes, in-car temperatures zip past 150° F.—enough to make the shimmering desert seem refreshing. As a result, most engineers recommend tinted glass. Chrysler automatically includes it.

A Little Planning Pays Off

How about the guy who's buying a new car and can't swing the extra cost of factory air although he'd like to add a hang-on when finances ease up? If you're caught in this bind, you can still get almost all the performance and efficiency of original equipment. It just takes a little forethought. Most needed modifications can be specified when you order the car. Try for as many as finances allow. You'll be surprised at the modest cost of things like oversize tires, HD fan, alternator and "mountain" or performance axles. Later,

(Please turn to page 202)



They're Firing

Launched from a Utah desert, missiles soar over people, impact on U.S. soil and provide data that would be lost at sea

By Frank A. Tinker

LAST FALL a slender missile arched into the vacuum of space, shedding burned-out stages as it rose. The remaining stages, lifting an intricate payload, aimed themselves precisely through a pinpointed keyhole in the sky. At impact, 580.2 seconds and more than 400 miles from launch, the "shot" had served a multitude of uses vital to the nation and had proved a crucial point.

For this high-performance vehicle—the *Athena*—was not lost in the sea, nor was its performance observable by prying "trawlers." Its total flight path lay over inland states, where exact measuring sites could calculate every

Missiles Over Our Heads

function and result, and where every particle could be recovered.

Almost overlooked in the shadow of our more spectacular orbital and weaponry shots from the ocean ranges at Cape Kennedy and Vandenberg Air Force Base is the fact that the United States now has a relatively long-distance, inland missile range. The launch site is Green River, Utah, 425 miles northwest of the thoroughly instrumented and securely guarded impact area in New Mexico's famed White Sands Missile Range.

It has long been recognized that our defense effort requires such a remote land range where activities cannot be monitored by sea-going spies. Also, the more convenient, inexpensive and precise placement of elaborate instruments on solid earth can measure performance data more reliably than instruments on ocean vessels.

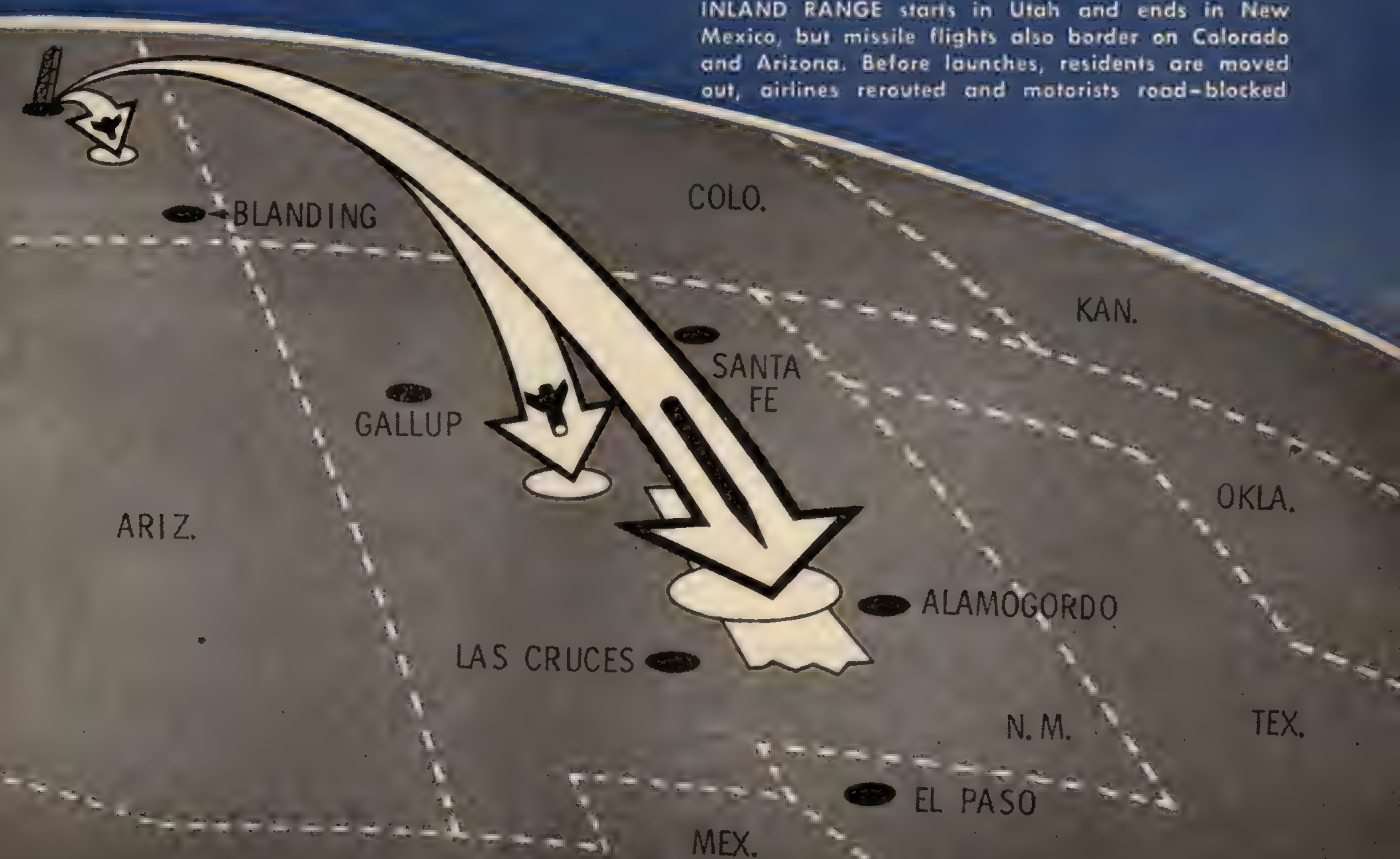
But the housekeeping problems are formidable. Airline routes cross the

range, and all flights must be detoured during firing. Even the frequencies to be used are guarded by two ground stations and one airborne watchdog to make sure important commands and information are not confounded by interference.

With each shot approximately 900 residents of Utah ranches and areas surrounding the town of Datil, N. M., must evacuate their homes. Notice is sent to these cooperative citizens by mail 20 days in advance of each launch. Then a deputy sheriff calls to make sure the notice is acknowledged. During hours of firing, instead of being escorted out of danger by officials, residents leave voluntarily. Actually, this may prove a windfall to the low-income area, since adults receive \$12 and children \$6 for each evacuation, as well as a travel payment of 10 cents per mile.

When residents are clear and road-blocks are set up at highways crossing the safety zones, the land is considered

INLAND RANGE starts in Utah and ends in New Mexico, but missile flights also border on Colorado and Arizona. Before launches, residents are moved out, airlines rerouted and motorists road-blocked





ATHENA MISSILE, slim, four-stage rocket, is launched from derrick-like tower at Green River, Utah. Its payload will come to earth more than 400 miles away

safe and secure during the firing period.

First major assignment for the new range has been the study of re-entry phenomena associated with high-speed ballistic missiles that may be used in actual combat. What is the exact nature of the "signature" left by each ICBM warhead and its possible decoys as they enter the upper atmosphere inbound on a mission? How best can our own missiles be made invulnerable to defense? These are a few of the questions scientists attempt to answer with their 400-mile shooting gallery.

Obviously, it would be almost prohibitively expensive to use actual ICBMs in the many tests needed. So scale-model payloads are the answer, fired in the security of the inland range. For these flights the 49-foot, four-stage, solid-fueled, 16,000-pound *Athena* missile was chosen.

Although it was given the unkind nickname of 'flying junkpile' when first pro-



COUNTDOWN BEGINS in blockhouse early in day. Weather is important. If wind might blow missile off course, endangering population, flight is scrubbed

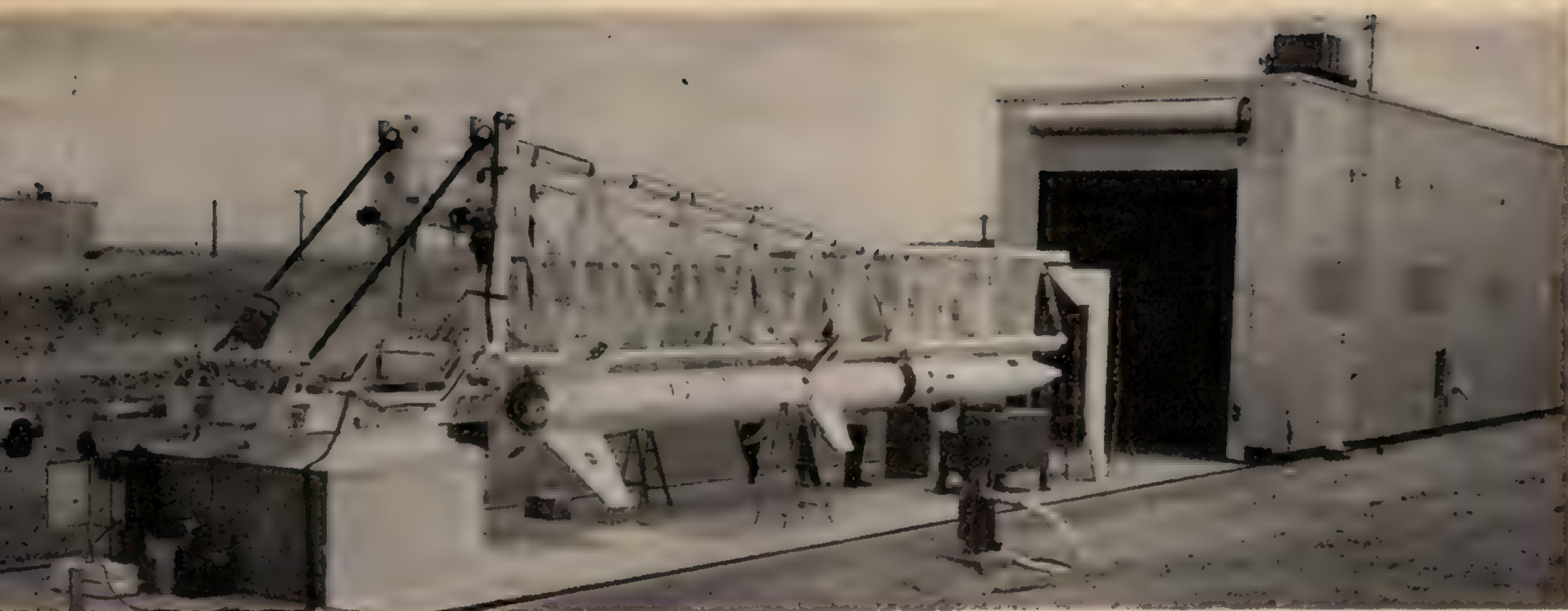


FIRST-STAGE booster, after separation, floats to earth on range south of Green River. Missiles are aimed so all stages impact in preselected areas

posed, *Athena* is actually an economical combination of proven, off-the-shelf components. Following its flight over western America is impressive both from the standpoint of its task as well as the tracking and computing chores which the range itself faces.

Let's sit in on one of these flights. . . .

Athena is launched from an elevated rail at Green River—aimed precisely both in elevation and azimuth. Since its first two propulsion stages are unguided, accuracy here depends heavily upon knowing wind conditions through the entire layer-cake of air currents from ground level to the top of the atmosphere. Prior to each launch, transmitter-carrying balloons are tracked by special theodolites to 10,000 feet. Radar follows small high-altitude rockets to 50,000 feet. Meteorological information from these and other sources are fed into a computer which calculates the



ATHENA HOUSING is rolled away prior to launch. Athena is kept inside, at controlled temperatures, until last possible moment. Tower is then elevated to precise angle and direction determined by weather conditions

To the Motorist:

With your assistance the United States Army and Air Force are cooperating in a series of rocket tests from near Green River, Utah. The test rockets are launched from the White Sands Missile Range test complex in this vicinity and land within the main White Sands Missile Range, some 425 miles away in southern New Mexico.

Because the road which you are traveling passes through an area over which part of the missile is jettisoned, your trip has been halted briefly to assure your safety. You will be allowed to continue as soon as it is safe for you to proceed.

LETTER TO MOTORISTS asks for their cooperation after roadblocks have been set up isolating path under missile flight. Advantage of inland range is that missiles can be recovered and reveal more data on their flights

launching angle based on conditions to 300,000 feet.

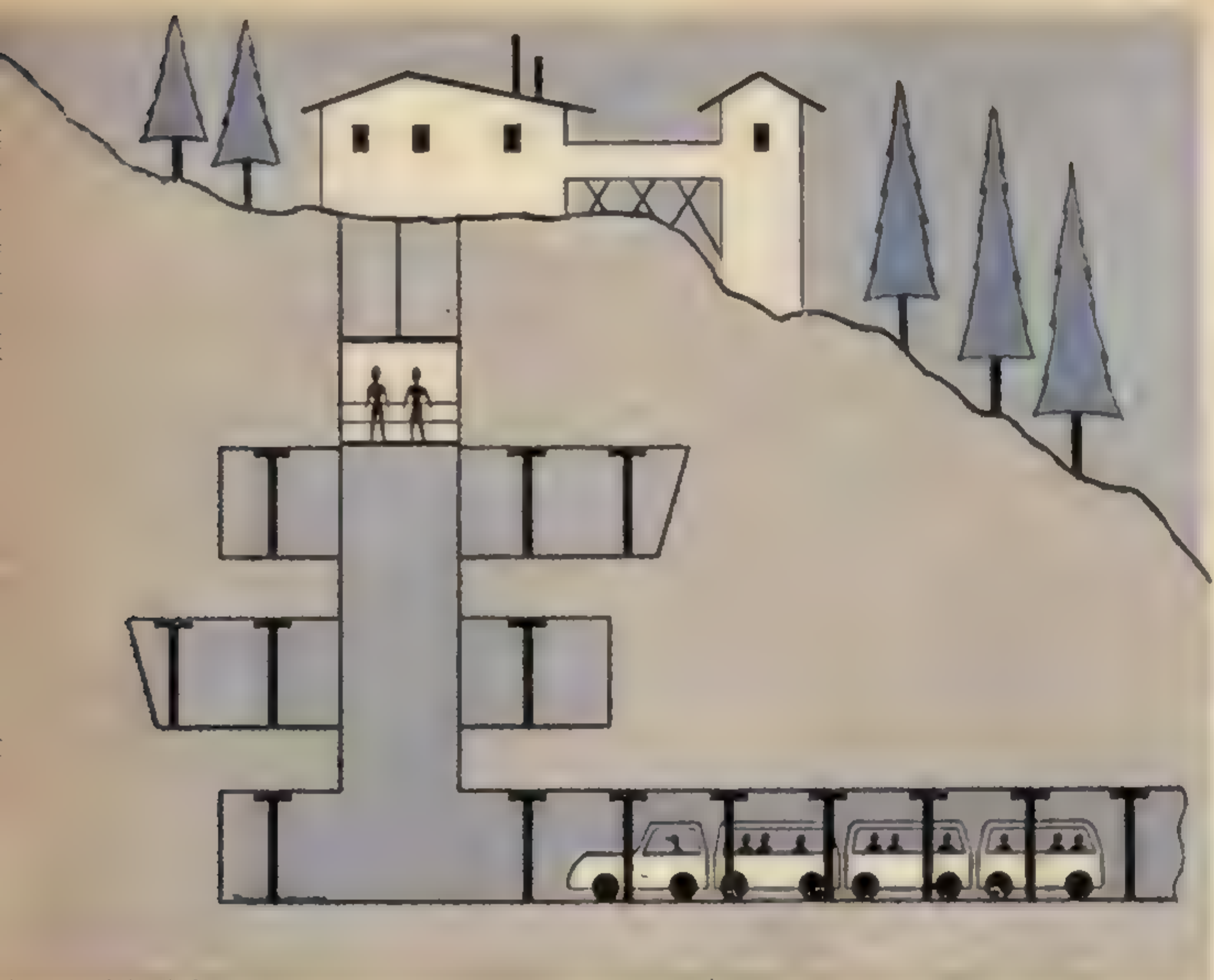
Changes can be made in the launch rail right down to T-minus-90 seconds. If the missile must be pointed too far off a direct course to White Sands, even though calculations show that winds would bring it into the proper impact area, the firing is cancelled rather than risk dropping any part outside the safety zones.

Athena is blasted from its guide rail by the 50,000-pound thrust of a large *Castor* solid-propellant motor, assisted by two smaller *Recruit* boosters. As it leaves the rail a 15-millisecond delay switch is thrown. This enables the entire missile to clear the launcher before two small rockets at the outer edges of its fins are fired. These impart a three-revolutions-per-second spin to the vehicle. Such rotation lends gyroscopic stability to this part of the flight.

Forty seconds later the first stage burns out and the booster case is jettisoned into the evacuated safety zone 40 miles down-range. The second stage booster ignites, producing a thrust of 21,000 pounds for another 35 seconds. It will generate more thrust for a shorter time if a low trajectory is being used. This gives the *Athena* sufficient velocity to continue upward from its present altitude of 300,000 feet to approximately 950,000 feet. The second-stage booster, when separated, coasts far on into New Mexico and lands near Datil if this is a low-trajectory launch; if high, it lands on White Sands itself.

And now the missile's intricate control section, and its "velocity package" consisting of the third and fourth stages plus the payload nose cone, reaches the top of its flight. Here a mechanical system, called a "yo-yo" in the jargon of the blockhouse,

(Please turn to page 198)



Skiers Go Under the Mountain to Get to Top

A three-mile tunnel running deep into the Treasure Mountains of Utah has become the world's first underground ski lift.

Resurrecting the famous Spiro Tunnel, a silver mine dating back to the early 1900s, the developers of Treasure Moun-

tain Ski Area at Park City, Utah, have built special ski trains towed by an electric locomotive that hauls the skiers into the mountain. At the end of the train ride they transfer to an elevator that was formerly a "hoist cage" for miners, and they

Lightweight 'Scope Zooms in for Close Look

By turning a knurled ring on a new zoom telescope, you can vary its magnification from 6 to 18 power. The sturdy, lightweight instrument should prove especially useful to varmint hunters, who could use the low magnifications to locate game, the higher ones to pinpoint it and make a positive identification before shooting. The scope lists at \$14.95. From Saul Bower, 114 Liberty Street, New York, N.Y.



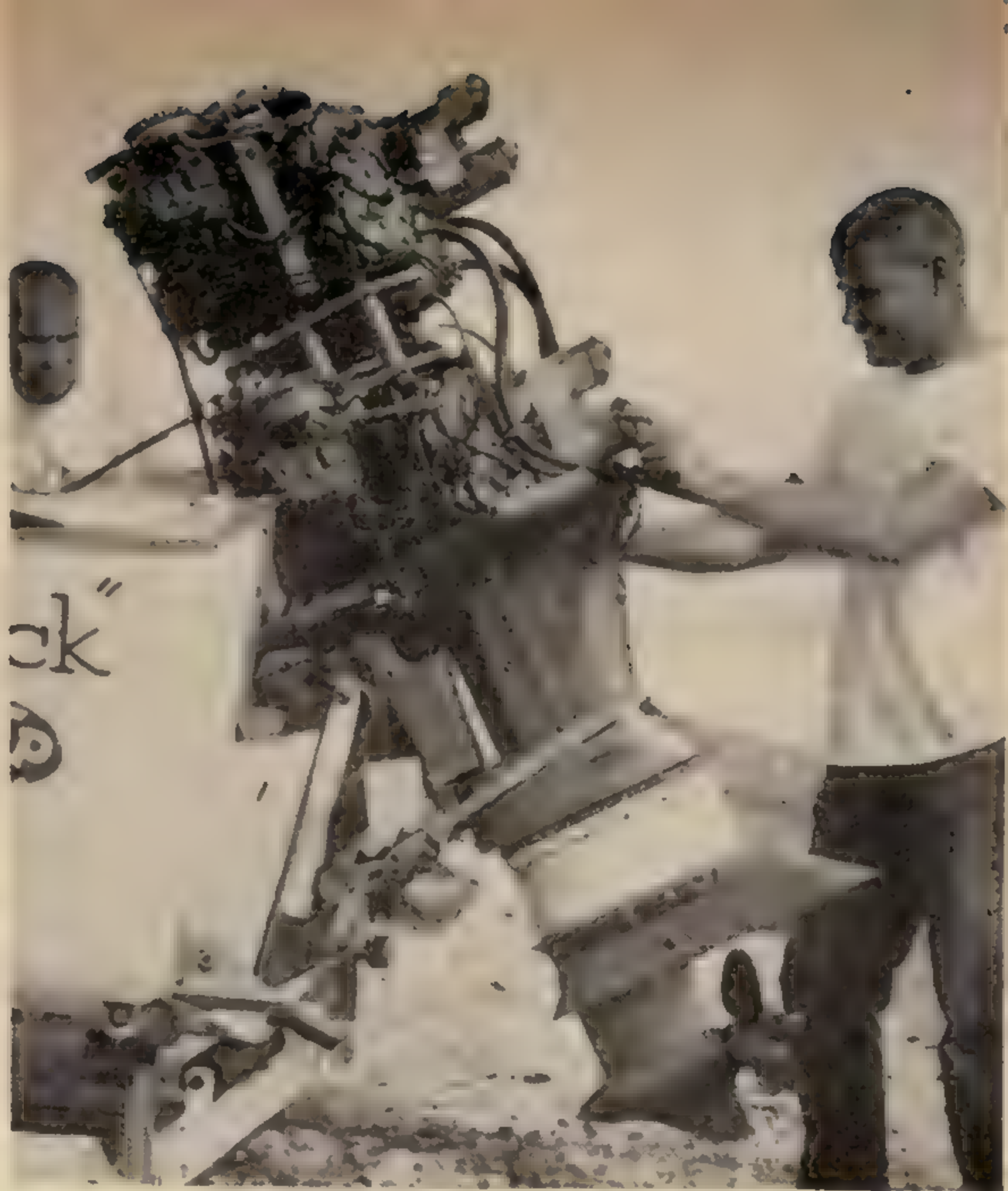


are then lifted 1800 feet to the surface.

The steel cars of the train are enclosed with sliding doors, and the skis are carried in special ski rack cars. A double chair lift starting at the elevator exit takes skiers to the summit.

Ballot Punchers

Voting by punch card—so that ballots are counted electronically—is reported to speed election returns and cut costs. (An election official in San Joaquin County, Calif., reported a \$15,000 saving over paper ballots in a recent election.) Photo shows a voter puncturing Votomatic ballot.



Piggyback V8 Outboard

Boat racers Ted and Gary Miller, Venice, Calif., are running what must be the world's only Johnson V8 on their 16-foot Glasspar, made by stacking two 75-hp V4s. Gears in the stock lower unit wear out in six hours under the terrific strain.

No-Shock Electric Garden Tool

An all-purpose garden tool, which does such jobs as cutting grass and shaping evergreens, has a plastic body and heavy internal insulation, to prevent shock hazard while working on wet soil. The grass shear costs \$26.88; Rockwell Mfg., Rockwell Bldg., Pittsburgh 15208.



PM OWNERS REPORT

PONTIAC TEMPEST

A Nationwide Survey
Based on 812,305
Owner-Driven Miles

Light on Steering,

TWO-FINGER CONTROL thru a hard corner demonstrates easy steering, ranked seventh in popularity by the owners. We agreed with respondents who praised legibility of round gauges



HANDLING, the favorite Tempest feature, proved itself at Bridgehampton as well as on the street. Lean and sway are slight. Controls are light, but we thought steering felt a bit numb

Owners Like

Slick handling	(49.3%)
Uncluttered styling	(42.9%)
Pillowy ride	(29.3%)

But Dislike

Poor gas mileage	(15.1%)
Dashboard design	(13.2%)
Wind whistle	(11.2%)

Heavy at the Gas Pump

*Marginal and boldface comments by Alex Markovich,
PM's Associate Automotive Editor*

“WE NEED TWO CARS,” a New York salesman complains; “My wife won’t give up our new Tempest.” A North Carolina engineer vows: “I wouldn’t trade my Tempest for any other car.”

Meanwhile, in a bank in a small Louisiana town sits a disgruntled manager. “I like nothing about the car,” he says. “It stays in the shop too much for me to be able to find anything to like.”

PM sent questionnaires to Tempest, Tempest Custom, LeMans and GTO owners across the country, and got ecstatic comments from the 52.9 percent of respondents who rated their cars Excellent. This figure is below average for this year’s owner reports; but a healthy 35.8 percent rated their cars Good, a figure topped so far this year only by Corvair’s 36.5 percent. Only two percent—about par for our surveys—agreed with the Louisiana banker and rated their cars Poor.

But perhaps a more significant question asks “Would you buy another Tempest?” Yes was the answer given by 91.0 percent.

Many owners say they bought Tempests because they wanted a smaller, more economical car with big-car name, reputation and luxury. An Ohio housewife sums it up this way: “I got tired of big cars and big-car expenses.” She calls her station wagon “a luxury car at a compact price.”

But some owners complain they’re not getting the economy they expected. Among the brickbats, poor gas mileage ranks first.

“Before choosing my Tempest,” says a Connecticut salesman who drives a Six with automatic transmission, “I considered a Chevy, Olds and Caddy. I decided on a smaller car for economy, but have been disappointed.” He reported an overall 12.4 mpg.

In California, another salesman compares his Tempest with a ’57 or ’58 Chevrolet of similar price and concludes: “We obviously aren’t getting as much for our money as we used to.”

The bulk of the owners reported 14-15 mpg in city driving, 18 mpg on long trips and 16-17 mpg overall. Strangely, owners of Sixes complained loudest; 47.5 percent were unhappy with their mileage, compared with 36.1 percent overall. There was hardly a whimper from owners of 335-hp and 360-hp engines, who seem willing to pay for their extra performance.

We hooked up a flow meter and fifth wheel to our test car, a Tempest LeMans four-door with 285-hp V8, automatic transmission and 3.23 rear end and recorded these mileages: 22.73 at 30 mph; 21.15 at 40 mph; 19.79 at 50 mph; 18.86 at 60 mph; 16.09 at 70 mph; 15.4 overall.

Performance was lively. Shifting manually from Low to Drive, we batted out 0-60 in 8 seconds flat; in Drive, the run

**Ford is champ so far
with 62.3 percent
← Excellent ratings**

**Highest figure this year,
← except for Falcon
owners at 94.6 percent**

**It’s like spending your
← last dime on a
Popsicle and having it
fall off the stick**



WELL-HIDDEN GAS FILLER of Tempest draws lots of colorful language from gas-station attendants. "Gas filling is a mess," complains an Ohio assistant manager. "Gas shoots out with any kind of pump," as we found out for ourselves

A four-speed box, with its two extra → gears would improve these times considerably

A big change from the nervous cornering → of the early swing-axle Tempests

Detroit's new curved side windows were supposed to reduce wind noise. Complaints keep coming in →

Having more weight (52.1 percent) → in front helps

took 8.2 seconds. Our 40-60 time was 3.0 seconds and 50-70 was 4.1 seconds.

We were happy to see handling topping the list of best-liked features, because we gave our test car a workout at the Bridgehampton road-race circuit and liked the results. The car cornered safely, predictably and quickly, with a minimum of effort.

Brake fade wasn't excessive; after six hard stops (17-ft./sec/sec deceleration) at half-minute intervals, pedal pressure increased from 22 to 38 pounds. Brakes were sensitive to the wet test conditions and pulled to the side during stops, but full recovery from fade took just a few minutes.

It shouldn't surprise anyone that styling showed up as the second most popular feature in our survey. "The nicest looking car on the road," exulted an Iowa office worker. Styling details such as the steering wheel, headlights, taillights and "color harmony" also got their share of raves.

On the gripe list, the dashboard ranked—or rankled—second, just after poor gas mileage. Next came complaints about wind noise.

Following are some owners' comments, which tell you what it's like to live with a Tempest. We start with the five best-liked features.

"Handling is great, especially on corners."—Wisconsin draftsman.

"Easily handled in high winds."—Iowa plumber.

"I'm a new driver and have driven all winter in ice and snow. The car is so easy to handle, I'm never afraid."—New York billing-machine operator.

"Lines are clean and functional."—New Jersey businessman.

"I like the rear-end trim. Most larger models look like they have a pregnant rear fender."—Missouri salesman.

"Smooth ride, like a big car."—New Jersey chemical engineer.

"It looks like a big car."—Michigan salesman.

"Rides like a Cadillac."—Ohio finance-company representative.

Vinyl interior lasts longer and is easy to clean."—New Jersey teacher.

"Snappy performance for a small Six."—Michigan data-processing programmer.

"Tremendous pickup."—Iowa plumber.

Next, the top five complaints.

"Got better gas mileage on my Chevy V8 than on the Tempest Six."—Pennsylvania lineman.

"Mileage is about 10 mpg. We were told it would be at least 12 or 13."—Maryland stenographer.

"Using too much gas for a so-called compact."—Ohio factory worker.

"Dashboard doesn't go with the car. It looks too small."—Ohio machinist.

"I never did like tell-tale instruments."—Michigan design checker.

"A padded dash would be safer."—Ohio research engineer.

"Lots of wind noise along the side windows and vents."—Missouri physician.

"Wind noise is evident even when the windows are closed."—Ohio insurance agent.

"It rides like a beer wagon."—Florida finance analyst.

"Rear shocks are too weak. Dealer installed Load Levelers, but charged \$35."—Illinois farmer.

"The horn didn't work, the gas gauge was bad, there were loose bolts."—Missouri salesman.

"Sloppy trim and door fit."—New Jersey photo manager.

Now for more happy comments, numbering from six to ten.

"Small steering wheel is easy to handle."—New Jersey student.

"Steering is quick but not oversensitive."—Missouri mechanic.

← Trouble with tell-tale lights is that they don't tell the whole tale—just the punch line

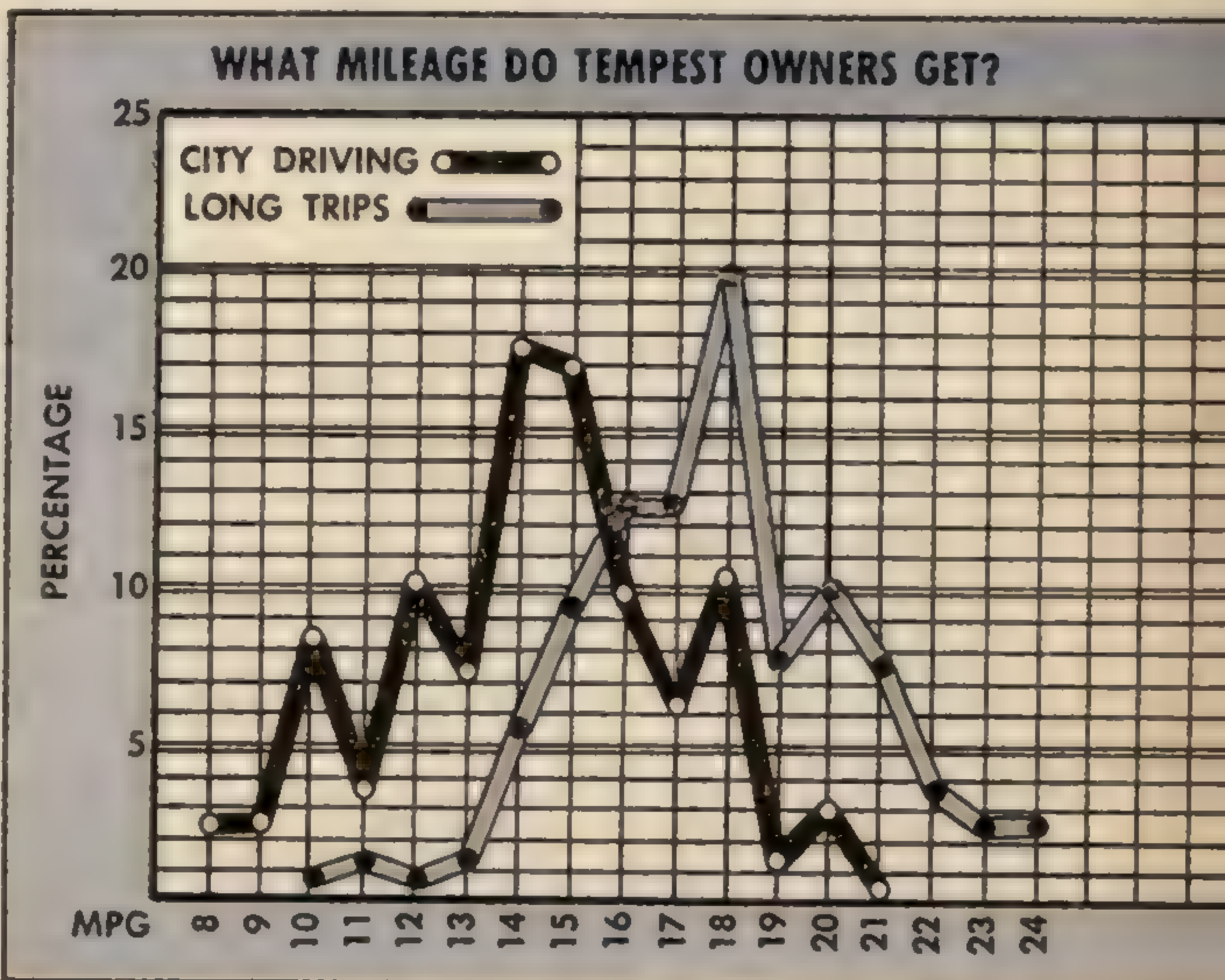
← You gotta ask for free-bies before you sign on the dotted line

← Our test car had unfinished welds in misaligned trim door jams and

← Overall ratios are about average—28.3:1 manual and 22.0:1 power

IGNITION SWITCH LOCATION at far left on dash was criticized by 5.4 percent of owners. It may be harder to reach, but it's much safer if you have children

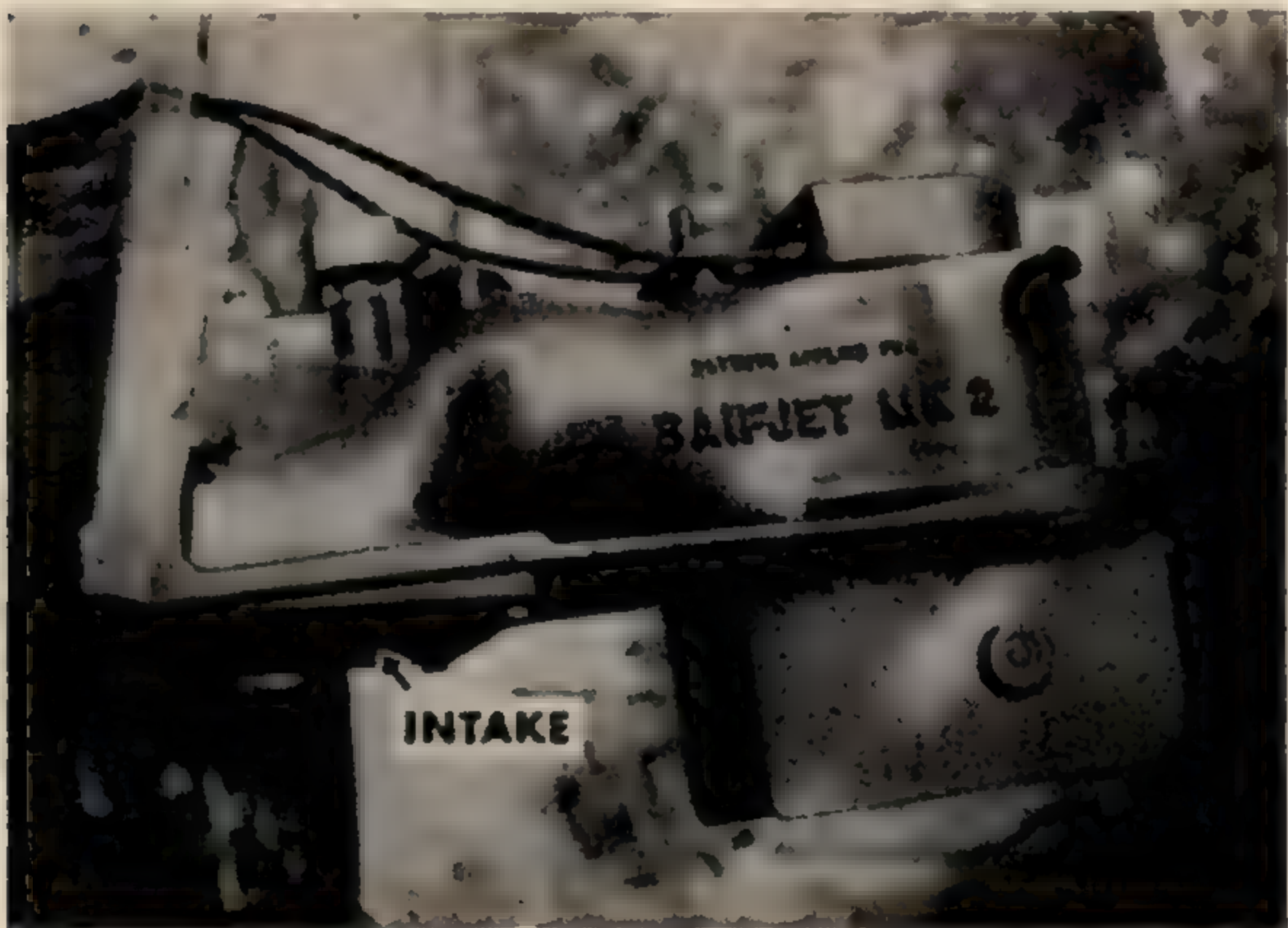
WIDE SPREAD IN GAS FIGURES springs from the variety of horsepowers offered. From 8 to 21 mpg was reported in city, 10 to 24 on long trips





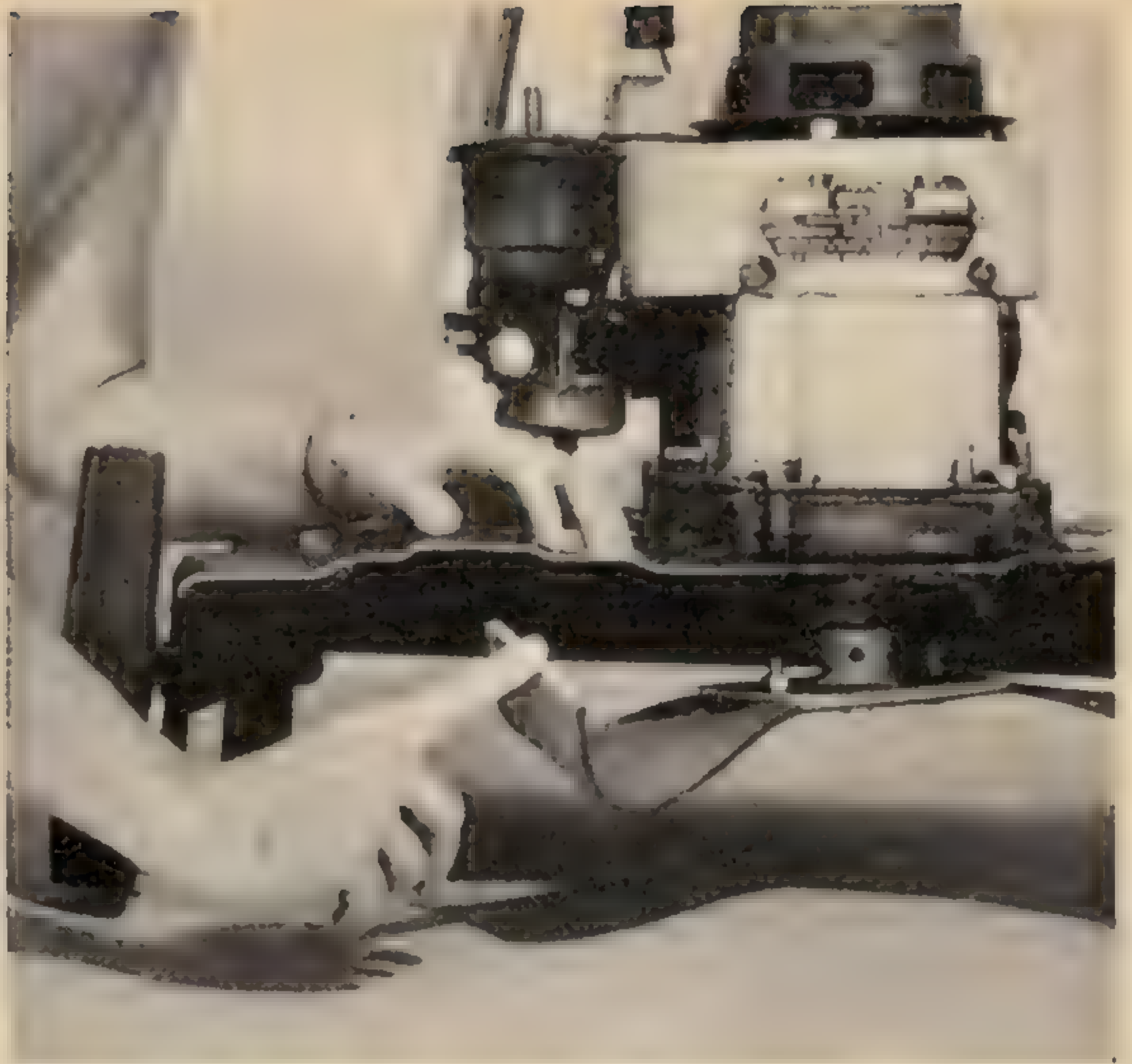
Midnight Light

Using an electronic tube that converts invisible infrared light to visible light, a binocularlike viewer enables the user to see objects in darkness. Completely self-contained, the International Telephone & Telegraph Corp. device is designed for military, police and darkroom technicians.



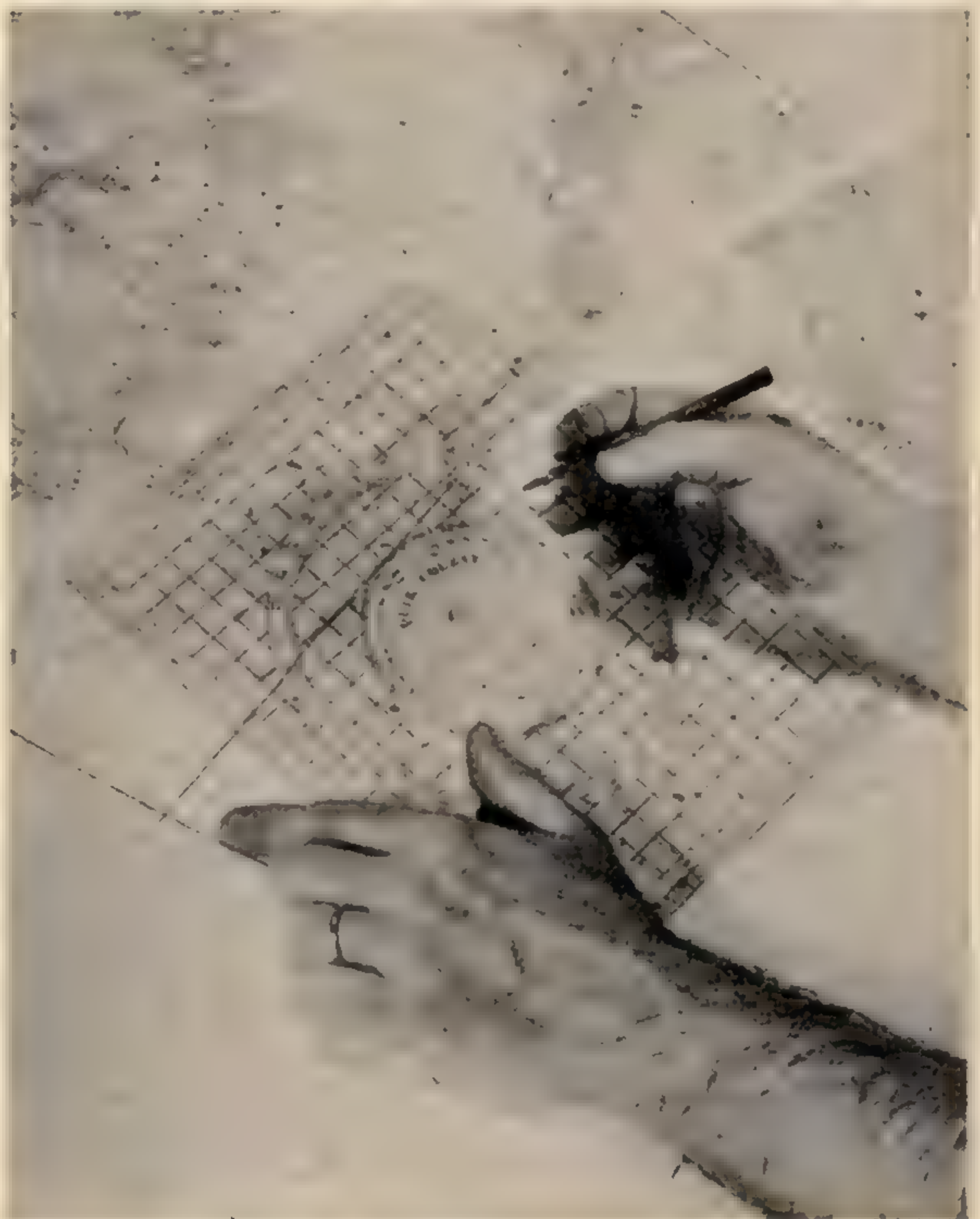
Outboard Jet

Designed to adapt to any engine of up to 16 hp, a British jet unit replaces the underwater propeller of inboard or outboard motors. It provides thrust on the water-pump principle, taking water into its scoop (arrow) and ejecting it in a high-speed stream. Propless boat can be driven into shallow water or beached.



Blade with a Twist

Deflecting when it strikes an obstruction, a new flexible blade for rotary mowers discharges debris harmlessly. With a nylon fitting for 18-to-25-inch mowers, the Saf-T-Mow blade is \$4.95 from K-D-B Enterprises, Box 2098, Decatur, Ill.



Small-Boat Plotter

Eliminating parallel rules and dividers usually used by boatmen, a new navigation plotter condenses all aids into one plastic piece that is a course finder, position plotter and distance finder. Aimed primarily at the man with the small craft, the "Quik-Course" costs \$3.95 from Bay Front Industries, Box 42, Nahant, Mass.

8

Ways to Show

Easy-over wake crossing, precision towing and feather-touch docking are handling tricks that separate the experts from first-season skippers

By Barry Burgoon

Leader of Cypress Garden's crack boat drill team, the White Angels



RIGHT



WRONG

SMOOTH OUT WAKES by crossing at an angle of about 20° . To minimize bounce and yaw, always back off on the throttle just before your bow hits the crest, then accelerate again as you go through the wake

LEAD WITH POWER when towing another boat in a crowded mooring or narrow channel. Since outboards steer from the stern, you'll have a lot more maneuverability if the boats are attached bow to bow with a short line and reverse gear is used. In open water, tow in conventional manner on long line



Your Boating Savvy

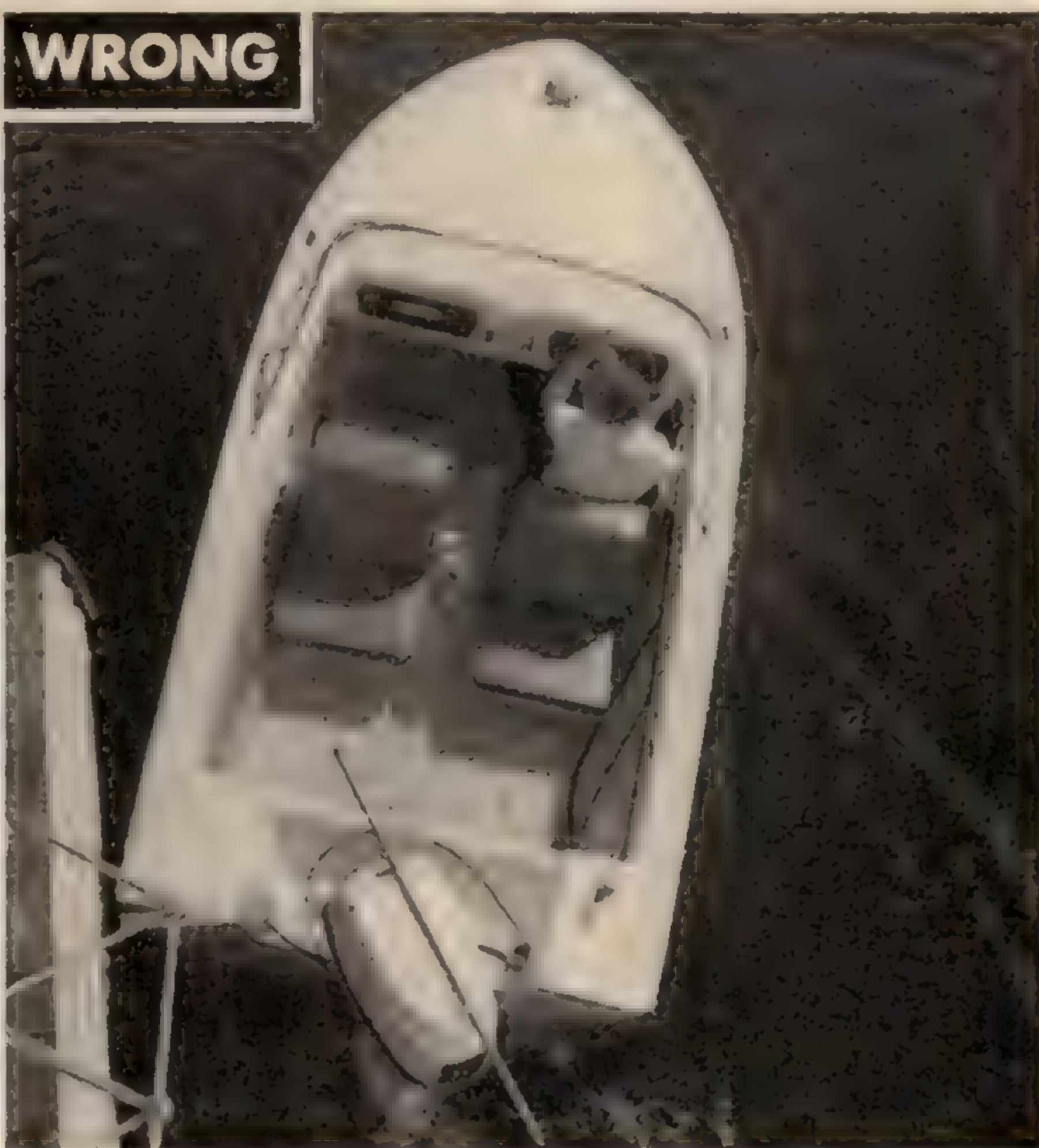
FROM WHAT I'VE SEEN, the average outboard owner is generally aware of standard boat handling techniques. He takes pride in doing the right thing in the right way at the right time, all with a casual no-sweat attitude.

Most of the tips included here, however,

aren't too well known even among experienced boaters. I've thrown in a few of the more common do's and don'ts because these still give some people trouble, and they can't be mentioned too often. But chances are you'll find at least one or two new ideas that will improve your skill.



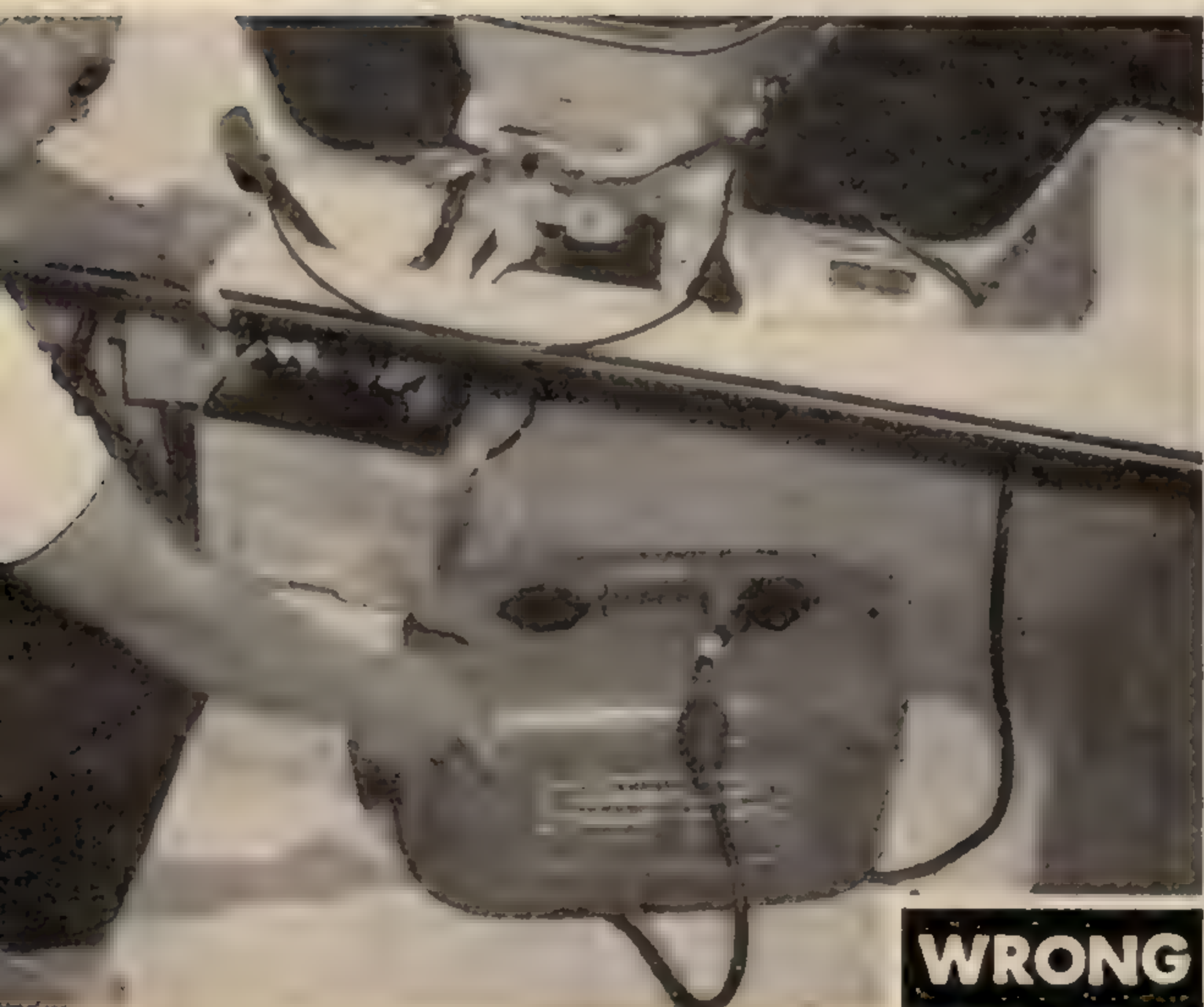
RIGHT



WRONG

GRACEFUL DEPARTURE shouldn't include banging the stern into the dock. One of the hardest things for new boaters to learn is to allow plenty of swinging room when leaving a dock or maneuvering in tight spots. Everybody knows that, unlike a car, a boat steers from the rear . . . but it's easy to forget

NEATNESS COUNTS when rigging your outboard. One of the most common causes of "engine failure" is a pinched fuel hose, so always make sure the fuel lines are attached tightly to engine and tank, and coil any surplus hose on the tank brackets. Remember this when you switch from one tank to another



WRONG



RIGHT



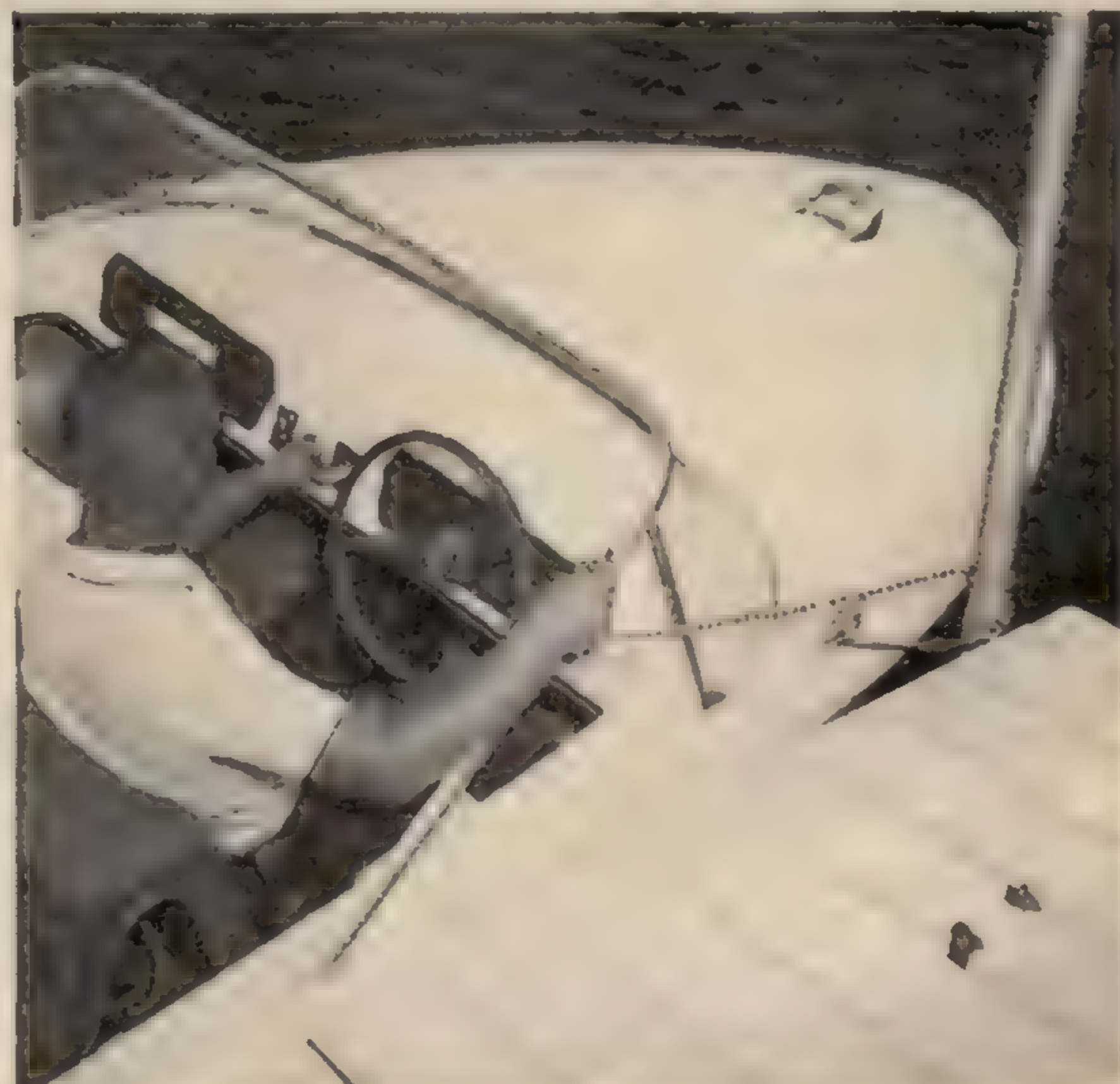
WATCH YOUR WAKE, since a skipper is always responsible for the wake manufactured by his craft. While most people think that throttling back will smooth out the wake, this isn't so. Take a few minutes to learn your "low wake speed" the next time you have the boat out, and use this speed when passing fishermen or other anchored boats. Don't depend on "No Wake" signs to jog your memory about this rule of courtesy

RIGHT

WRONG



◀ **RUN YOUR MOTOR DRY** before putting it in storage. At the end of the last day's run, pull the fuel line while the engine is still running to use up all the fuel in the carburetor. And if you protect the boat and motor with a cover, allow plenty of ventilation by not lashing it down too tight. This will prevent damaging condensation



ALWAYS START ENGINE before untying the boat from its mooring. This gives you immediate control of the boat and keeps you right where you should be in case the engine doesn't kick over on the first crank. Use mooring like a car's emergency brake

DON'T DEPEND ON REVERSE gear as a brake. Approach docks and other boats at a speed which won't get you into trouble if the engine stalls. And if the engine should die, don't panic. Shift into neutral and go through the standard starting procedures



Zooms on Batteries

Four penlight batteries power the zoom mechanism of a new telescope that provides from 2½ to 8 times magnification. Pushbuttons on the housing (far right) actuate the zoom. Scope weighs 44 ozs., is priced under \$200 with leather case. Kalimar, Inc., 2644 Michigan Ave., St. Louis, Mo.

New Tricks for an Old Foam

Thanks to a newly patented technique, polyurethane foam can now filter air, gases and liquids. The technique removes material from the foam's cell walls, leaving an open network called reticulated polyurethane. This material, a product of Scott Paper Co., has wide use in filters for air conditioners, humidifiers, gasoline engines and electric hair dryers.

In photo (right), water runs through reticulated urethane but can't penetrate conventional urethane foam.



Jet Landing Craft

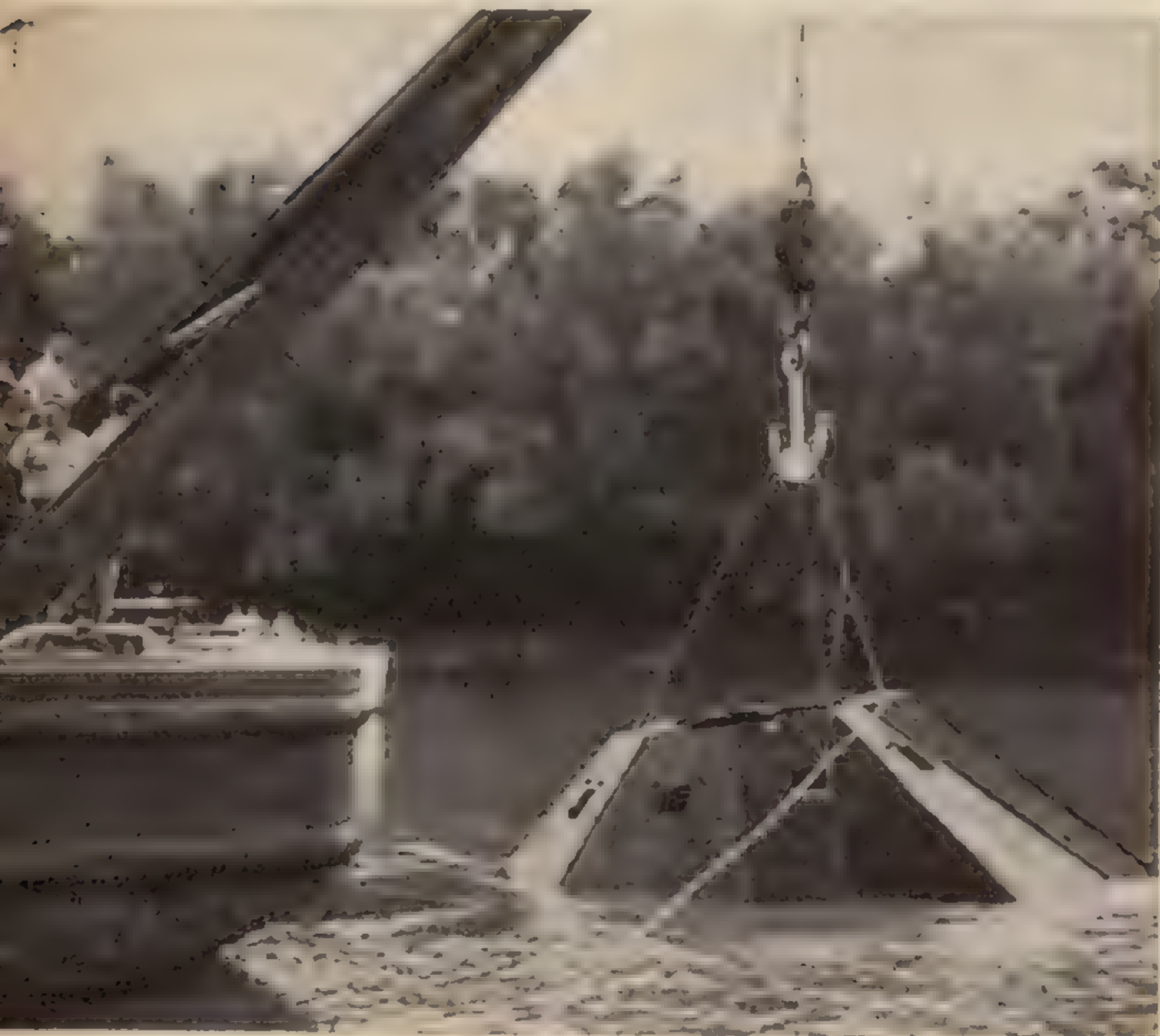
Amphibious troops may one day skim to the beaches in 70-mph water-jet assault craft. Working toward that goal, Lockheed-California is testing a 25-foot, 48-mph craft that rides above the waves on aluminum skis that retract into the hull when not in use.

THE YAZOO GIVES UP AN OLD

Naval guns loaded with grape-shot, firing caps in place, the last of the Civil War's ironclads rises from a muddy river to recall a black page in American history



SALVAGE OPERATION, which took four years, began in 1960 when pilot house was brought to surface. Amateur historians pinpointed site of wreck in 1956



OAK TIMBERS of Cairo's bow section, cut from Mid-western forests more than hundred years before, are in remarkable condition after century under water

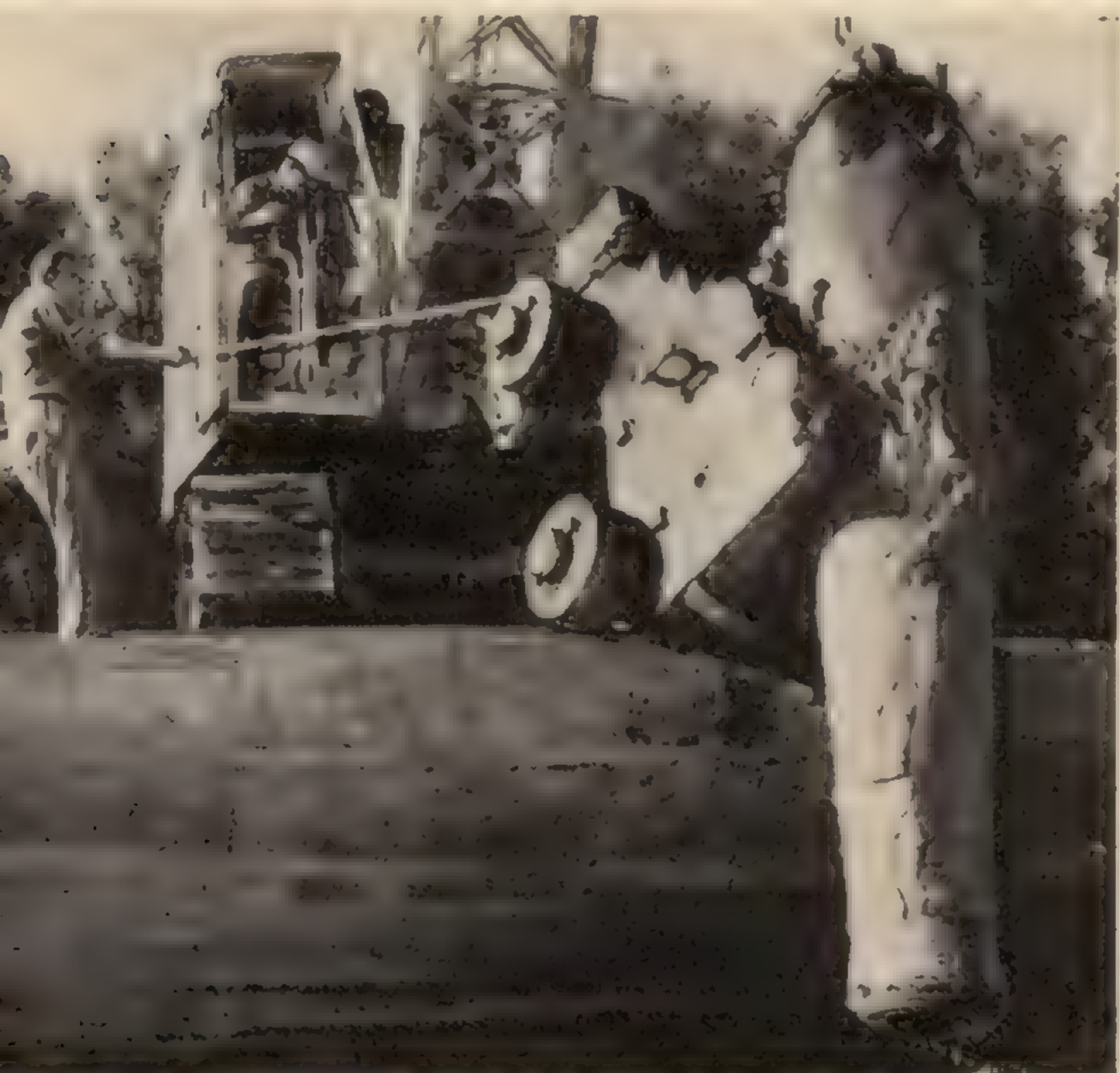


IRONCLAD



USS CAIRO as it was during its brief career in Civil War. Launched Jan. 15, 1862, it was sunk Dec. 12 of same year. It lay at bottom of the Yazoo River until resurrected late last year

HEAVY GUN, one of 13 aboard, is raised from watery grave. Hemp lines used to control gun's recoil were still intact until parted by salvage equipment



By William R. Wilson

TWO UNDERWATER BLASTS shattered the oaken hull of the ironclad USS *Cairo*, blew her bow anchor high into the air, tore one of her heavy guns from its carriage and sent her to the bottom of the Yazoo River 16 miles north of Vicksburg, Miss. That was on Dec. 12, 1862.

Now, more than a century after the Union gunboat was destroyed by its torpedo prey, forgotten and rediscovered, the remains have been salvaged through persistent efforts of a National Parks Service research historian and a determined band of volunteers. Through restoration now under way, the *Cairo* will live again as the last of the ironclads.

After the explosions, the 512-ton warship sank rapidly as a torrent of muddy water poured inside. In five minutes, her forward hold was flooded and the main gun deck awash. The crew manned steam and hand pumps, but failed in an effort to run her aground. Reluctantly the 26-year-old captain, Lt. Cmdr. Thomas O. Selfridge Jr., gave the order to abandon ship. In 12 minutes, only chimneys and jackstaff, with the Stars and Stripes still flying, were visible above water.

Miraculously, no lives were lost. While other vessels shelled both river banks, the ram *Queen of the West* rescued many of the crew, then pulled down *Cairo's* twin chimneys and jackstaff to hide her grave.

One of a fleet of seven ironclads built in 1861, *Cairo* was a flat-bottom, wooden steamboat propelled by a stern paddlewheel. She was armed with 13 heavy guns and protected by iron plates up to 2½ inches thick over her sloping casemate and octagonal pilot house. Drawing six feet of water with barely nine inches of freeboard, she was considered the fastest and most maneuverable of the ironclads supporting Gen. U. S. Grant's drive to clear the Mississippi and divide the Confederacy in two.

For years following the warship's fatal encounter with torpedoes, tons of silt and sand filtered inside her hull; the stern settled into the Yazoo's blue clay bottom. Finally, her location was forgotten. Her sister ships—those that survived the war—were sold at auction or scrapped, ending the existence of our nation's last inland-waterway navy.

For 94 years, the *Cairo* remained undis-



AERIAL VIEW of salvage site. Two main lifting barges flank submerged *Cairo*, indicated by shaded area. Note excavation of east bank of Yazoo river

turbed. Then, in 1956, Edwin C. Bearss, regional research historian at Vicksburg National Military Park, and amateur-historian Warren Grabau determined to find her. By studying official reports of the sinking and 1860 maps of the lower Yazoo, they pinpointed what they hoped was the likeliest location. In mid-November, when the river was at its lowest level, they took a boat upstream well past the site selected and moved back with the current.

Found by Pocket Compass

The men placed a small pocket compass in the bottom of the boat and took turns watching the needle. They noticed a slight deflection about a half-mile above their selected spot but after repeated passes they continued downstream. Then, as they came within 50 yards of their "optimum" location, the needle suddenly swung crazily halfway around its dial!

They steered over the location once more. Again the needle danced as though possessed. Something big and magnetic was in that muddy water below. It was almost certainly iron. Bearss and Grabau blazed a tree ashore to mark the site.

Several weeks of painstaking probing revealed a huge, slope-sided iron mass with a spongy upper deck. Dimensions appeared to match those of the ironclads. The little iron tower could easily be the

CAIRO RESURRECTION was finally accomplished in three sections after cables bit into hull while trying to bring it to surface complete in one piece

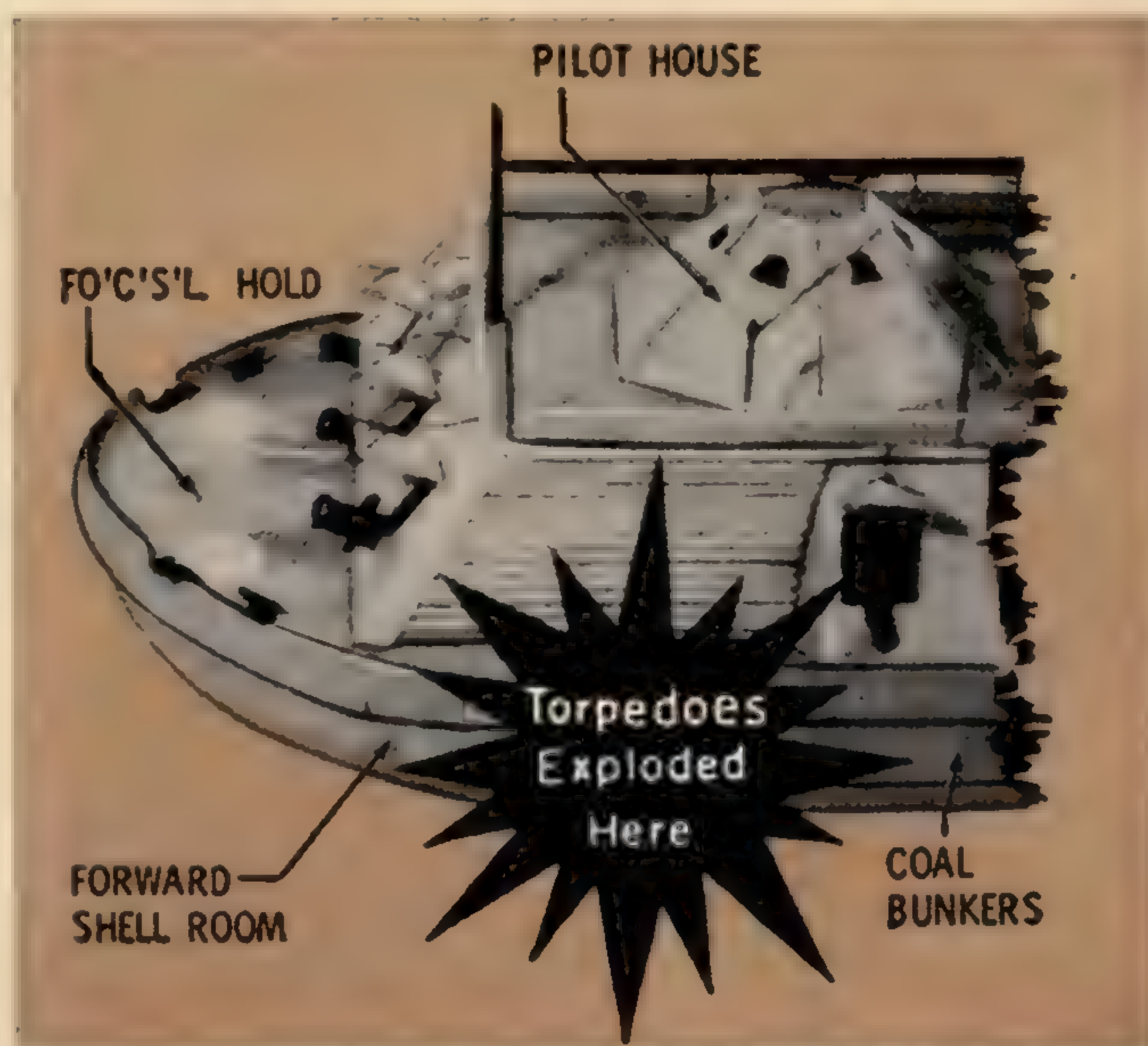


CAKED MUD is removed from ammunition with wire brush. Shown are grapeshot, cylindrical high-explosive shell and two sizes of round, solid shot

armored pilot house. Little by little, the evidence became indisputable. The *Cairo* had been found.

Lack of funds halted further exploratory work for three years. Late in 1959, two amateur divers, working blind in the murky water, made their way into the pilot house and found it partially filled with hard-packed sand. On deck they discovered the broken chimney stumps. The stern was completely buried. Entrance to the casemate was blocked by a tangled mass of waterlogged trees. The men contented themselves with salvaging some eight-inch spikes and the iron flaps from observation ports of the pilot house.

A tug arrived at the scene in Septem-





LOADED GUNS created another problem. Ordnance men pumped oil at high pressure into barrel and also tried explosive charge. Both attempts failed

ber, 1960, with a floating crane, its services donated. Volunteer divers had already pumped part of the sand from the pilot house. Now heavy cables were run through the observation ports and hooked to the crane. The pilot house and one of the mud-encrusted guns were soon lifted from the ironclad and deposited on a barge. Thorough scrubbing revealed a handsome eight-inch naval gun loaded with canister, firing cap in place and sight set at 350 yards!

Divers screening the mound of sand recovered several artillery swords, a Colt army revolver, soapdish, pitcher, wash-bowl, mirror, can of shoe polish, bottle of medicine and pieces of the *Cairo's* wheel.



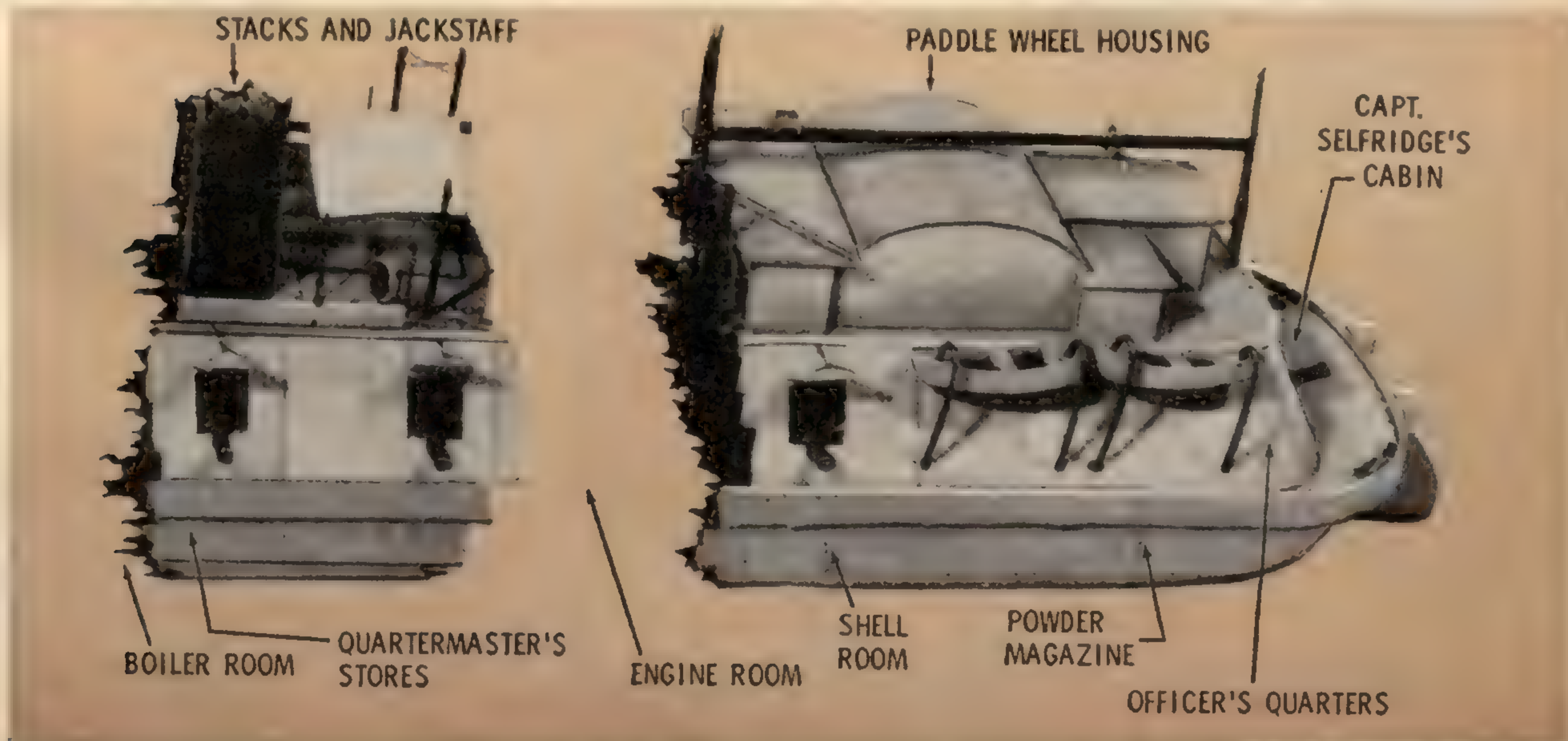
CAIRO'S ARTIFACTS, all identified with crewmen because of initials or marks on them, included pocket watch, tableware and some toilet articles

And, the shoe polish was still usable!

Amazed at the excellent state of preservation of things recovered from the wreck, the discoverers began to hope that the vessel itself might be salvaged intact. Divers lent encouragement, reporting that the oaken timbers seemed almost perfect. The gunboat's interior, as yet unexplored, was found to contain a wealth of Civil War artifacts.

An initial engineering survey had recommended dredging away portions of the river bottom which partially engulfed the boat. Heavy steel cables would then be passed beneath the hull and attached to partially submerged barges along both

(Please turn to page 192)





SURFACE DREDGE has a sluice box mounted on Styrofoam floats. The diver works underwater using the suction head like a vacuum cleaner to remove sand and gravel from the bedrock and expose the cracks and crevices where it is possible to discover the nuggets of gold

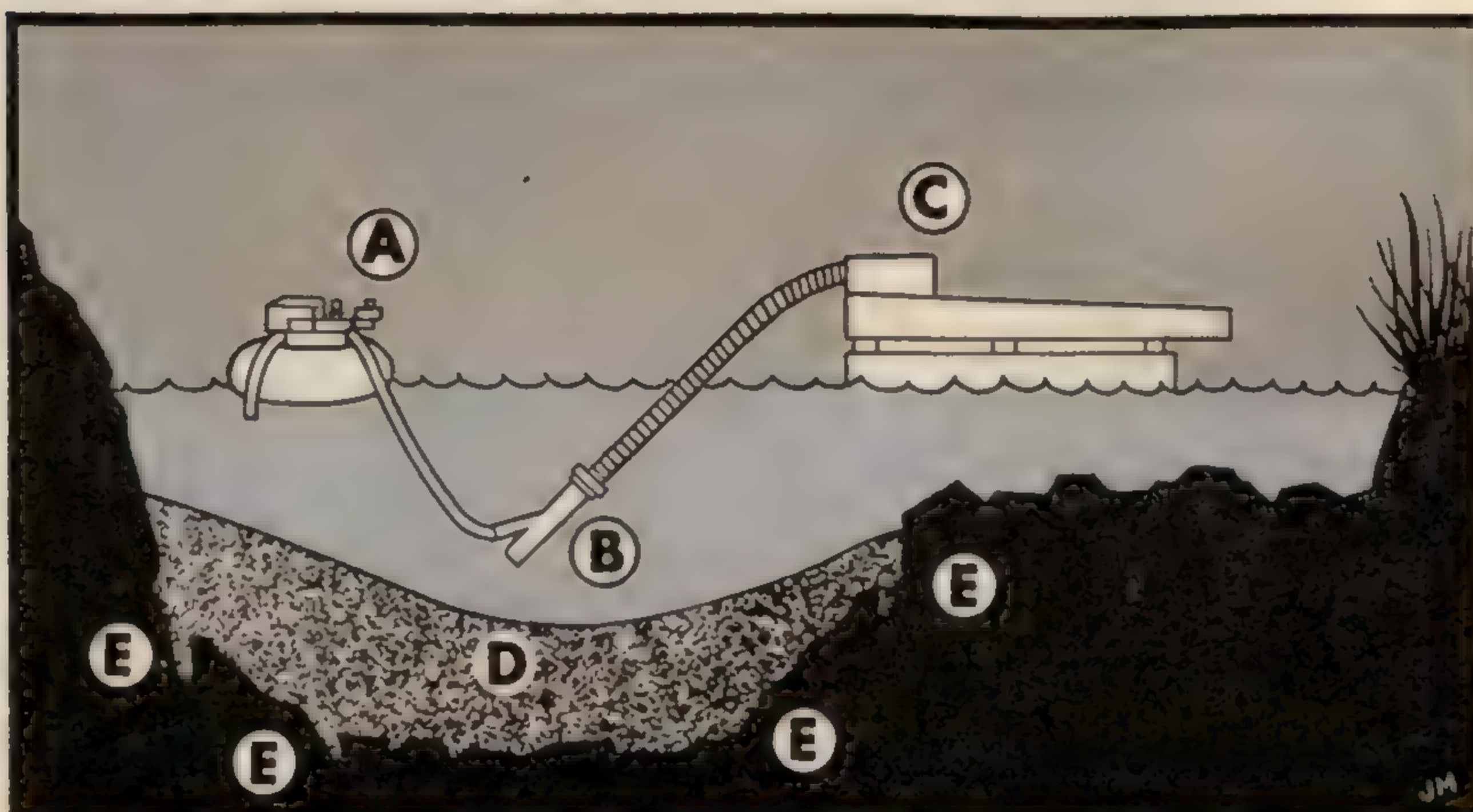
Glittering

Snipers, panners and scuba sourdoughs are crowding the "diggins" from Maine to California—you can join the new family sport of cleaning up what the '49ers left behind

"I'VE SEEN BOOMS IN MY TIME and men what had the fever real bad, but I ain't never seen nothin' like this. Everybody's panning, even the women and kids."

A grizzled prospector who has worked the Sierra Nevada Mountains for 40 years was complaining about what is happening on the rivers and streams from California to the Appalachians.

SURFACE DREDGE OPERATION requires a water pump (A) mounted on an inner tube, a vacuum head (B) and sluice box (C). When gravel (D) is removed, gold nuggets are discovered in crevices (E) at bedrock





SNIPING FOR GOLD, prospector cleans out a rock crevice (A) with a knife. With the pan underwater (B), he washes the pay dirt, breaking up lumps and washing off roots and moss. When loose material is floated away he begins to pan (C). Tilted pan is worked back and forth, clockwise and counterclockwise. Light material is sloshed off the top, and any gold settles on the bottom of the pan with the black sand

Gold Rush Vacation

"Why, during the summer you can't hardly get elbow room on the Yuba," he said. "They're turning the whole Mother Lode into an Easter egg hunt."

There is a gold rush going on in the United States but unlike the madness of 1849 that sent seemingly sensible men into the hills in search of riches, and the depression of 1930 that sent them after gold out of desperation, the "boom" of the 60s is strictly for family fun.

"We've been panning for gold for about two years," said a school teacher from Monterey, Calif., who was camped with

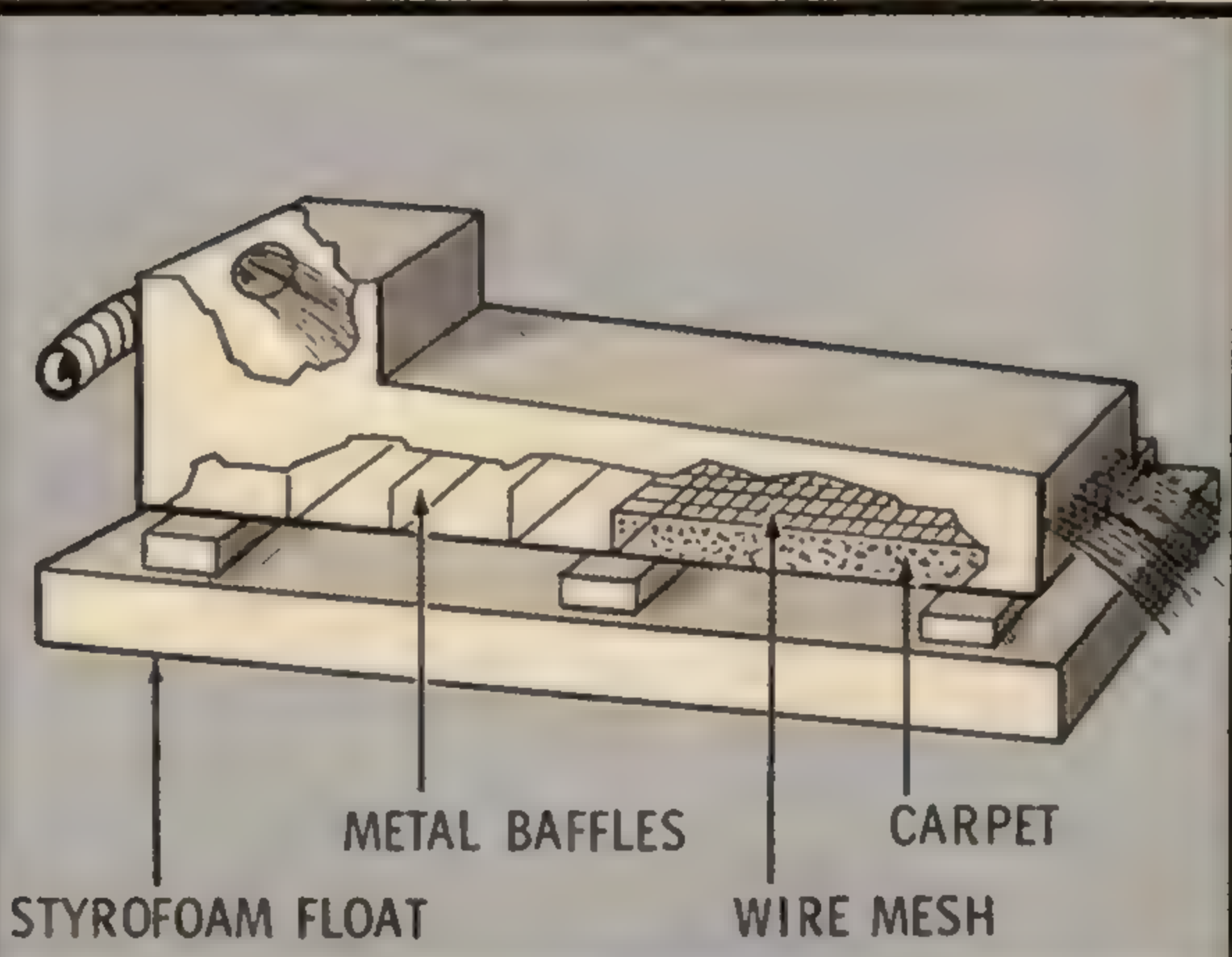
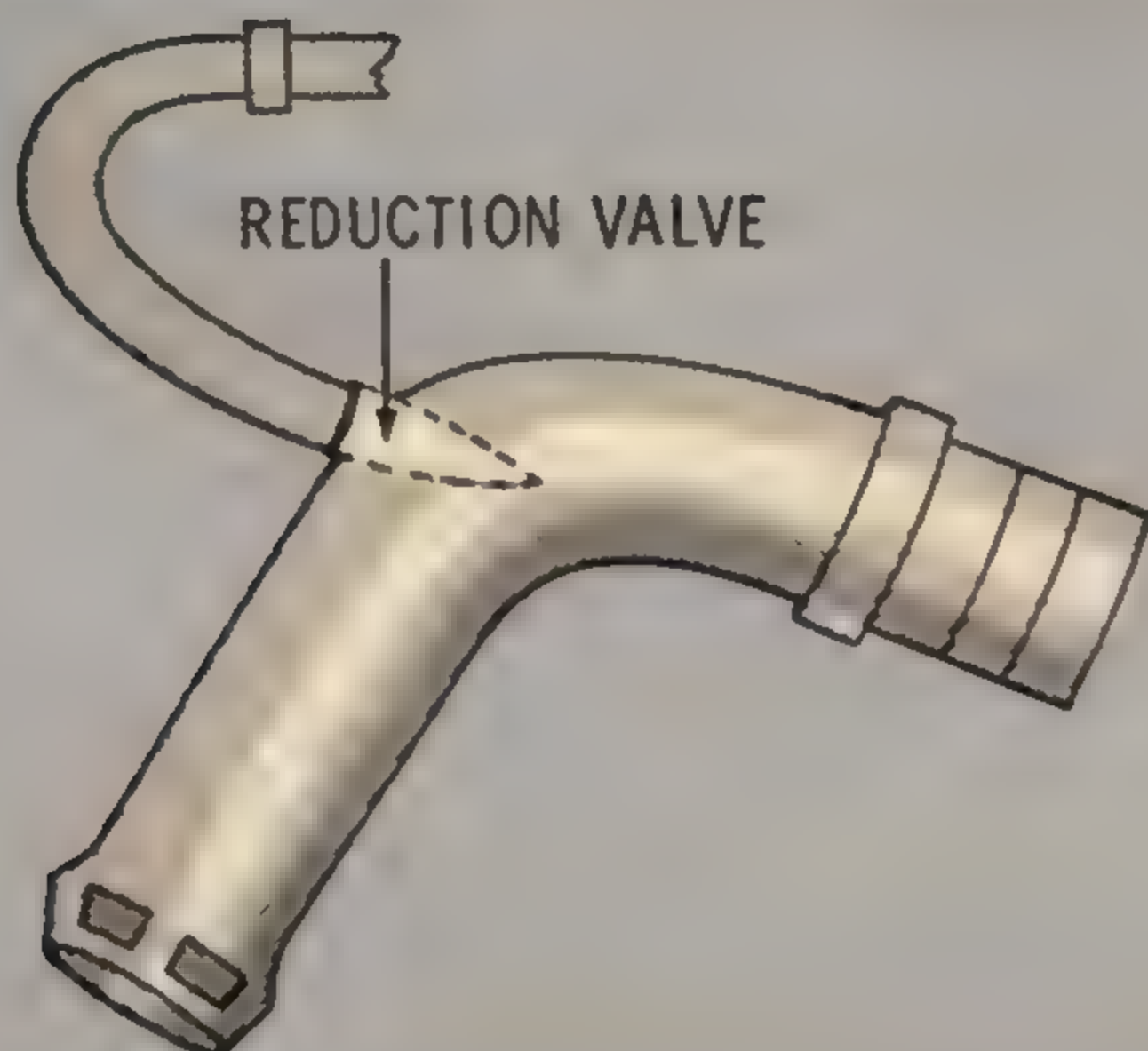
his wife and two children on the banks of the Yuba River, about six miles west of Downieville, Calif. "We spend a two-week vacation up here and also try to get away on weekends when we can. I don't suppose we've found more than \$50 worth of gold, but you couldn't put a price on the amount of fun we've had."

"It's the excitement," said another part-time prospector, a lathe operator from Sacramento. "You fill your pan with dirt and start washing it down, and at the bottom you might get the prize."

More serious than the panners, but also

SUCTION is created in mouth of the vacuum head by pumping water into the hose through a reduction valve. Water pressure lifts material to the surface

SAND AND GRAVEL is dumped into sluice box. Metal baffles stop heavier materials. Smaller particles fall through wire mesh and carpet holds flour gold





MIGHTY MIDAS is a dry concentrator. Pay dirt drops onto a small table where constant air flow and vibration separates the gold from lighter materials



GIANT "MIXMASTER" separates gold by centrifugal force. Pay dirt and flow of water are spun in bowl where three baffles obstruct action and trap gold

PLACER DEPOSITS in 28 states are marked on map in color. While most areas are not commercially active, they are all hunting grounds for the amateur



regarding the search for gold as a sport, are the skin divers who work the river bottoms with a variety of suction devices that resemble vacuum cleaners. Their equipment will mean an investment of from \$200 to \$1000, but it is the best way to get down to bedrock and real paydirt.

Placer gold, which is what the vacation sourdoughs are seeking, is the result of erosion. Gold-bearing rock is worn away from a lode (a mineralized vein or mass of ore in country rock) by a natural force such as running water. As it is carried downstream the rock is worn away and broken up, and the pure gold in flakes and nuggets is liberated. The largest and heaviest material sinks to the bottom, gradually sifting down through deposits of gravel and black sand until it reaches bedrock.

Using a suction dredge, a hose with a four to six-inch mouthpiece, the diver vacuums up the sand and gravel, running it through a sluice box to extract whatever

gold is with this material. When he reaches bedrock he cleans the cracks and crevices.

"This is where you make it or go broke," said Buddy Graham of Bakersfield, Calif., who was working a dredge with two friends. "You can make expenses from the flour gold (tiny flakes) that you get out of the sand, but the paydirt is on the bottom. We've only opened one crack and found a string of nuggets, so it looks good."

Graham is using a surface dredge, the most efficient and expensive of the vacuum units. A 6-hp engine mounted on a large inner tube operates a water pump and an air compressor. Water is forced through a reduction valve above the mouthpiece of the hose, creating the suction that lifts the gravel. When the material is dumped into the sluice box, which is mounted on Styrofoam floats, it runs over a series of baffles and a wire mesh. Gold nuggets are caught by the baffles, and a piece of carpet under

(Please turn to page 190)

RIFFLE BOX suction pump is used by divers in shallow water. Water pressure creates vacuum to suck materials through the long box. Riffle box near the end catches black sand, which is later panned out for flakes of gold







Nice Twist in a Tight Squeeze

A tiny Italian car, the Urbanina, may be an answer to big-city parking problems. When it's squeezed into a tight parking spot, a pull of the lever rotates the body and allows passengers to exit from the front or rear (photo, far left).

Equipped with interchangeable bodies (center photo), the car can be made into an open vehicle in minutes (left).

The Urbanina is 76 inches long, 50 inches wide and has a 12-cubic-inch, 7-hp, 2-stroke engine under the chassis. A 40-mph top speed and 100 mpg are claimed. The inventor, Marquis Piero Bargagli, expects to sell it in Italy for about \$500.



Fire-Fighting Grenades

A new fire-fighting weapon, the Gren-Gun, uses air pressure to hurl chemical-filled plastic grenades (far left) into hazardous or inaccessible places. It can hit targets 100 feet up or 200 feet away.

The gun can be "charged" from any source that will deliver air at a pressure of 150 psi. A 9-pound backpack air bottle commonly carried on fire engines will fire over 60 grenades.

Grenades are shot from a four-barrel magazine and are exploded by the release of high-pressure carbon dioxide from a cartridge that's part of a time-delay fuse. The burst produces a fire-blanketing chemical cloud (left). The maker is the American Research Corp., Rockville, Md.



Bulletproof Iron Curtain

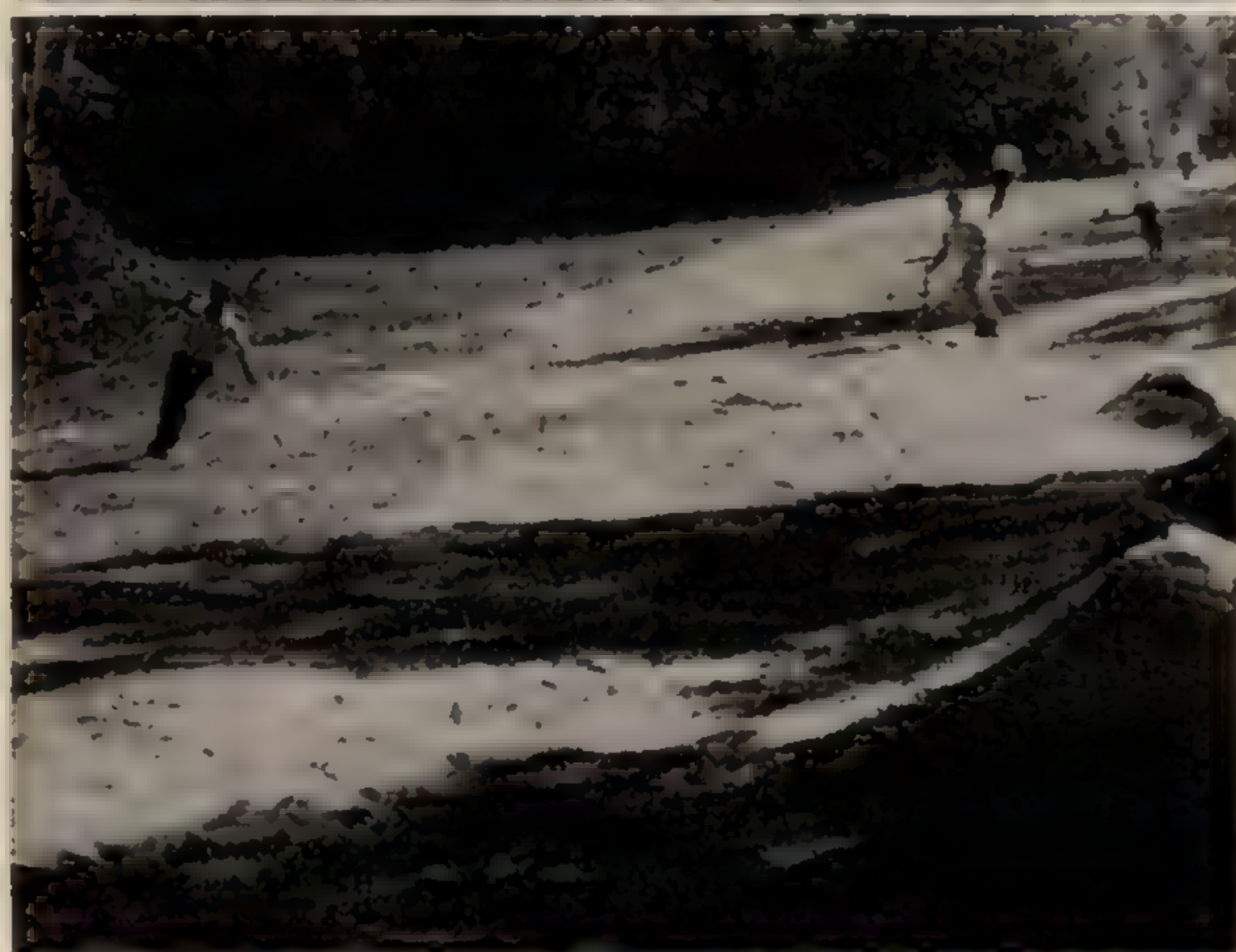
Operated by compressed air, a bullet-proof shield shoots up in front of bank cashiers confronted by bandits in a German bank. Made from layers of steel and thick rubber, it has withstood bullets up to 9 mm (about .38 cal.) at close range.

Faced by a bandit (far left), the cashier presses a button (center) to trigger the shield. It shoots up with a loud bang about four feet in the air, starts a hidden camera and sets off the police alarm.

The compressed-air unit can operate up to 10 curtains, each weighing about 400 pounds. The curtain is the work of a German engineer specializing in anti-thief devices.



HONEYCOMB OF VINYL bristles provides surface that skiers say "gives" enough to permit the same edging and weight control that are used on the real thing



CHIPS ARE ROUGH on skis but provide good off-season sport. But taking a spill at Hunter Mountain (above) is said to be "like falling in wet rice"

Snowless Skiing on Bristles and Chips

SKIING IN JULY is no trick if you happen to be at New York State's Hunter Mountain Ski Bowl, where a double chairlift is kept busy on summer weekends lifting shorts-clad skiers to the top of a 1200-foot plastic-covered slope.

The artificial surface was first tried last year. It's made up of a two-inch base of aggregate (covered by a fine-mesh nylon net to hold it in place) and a three-inch layer of plastic chips. The chips, about 1/4-inch in size, are made from solid polyethylene and nylon tubes and sheets obtained as salvage from factories.

The surface feels and performs like springtime corn snow, say skiers. Because the chips cut up ordinary ski bottoms,

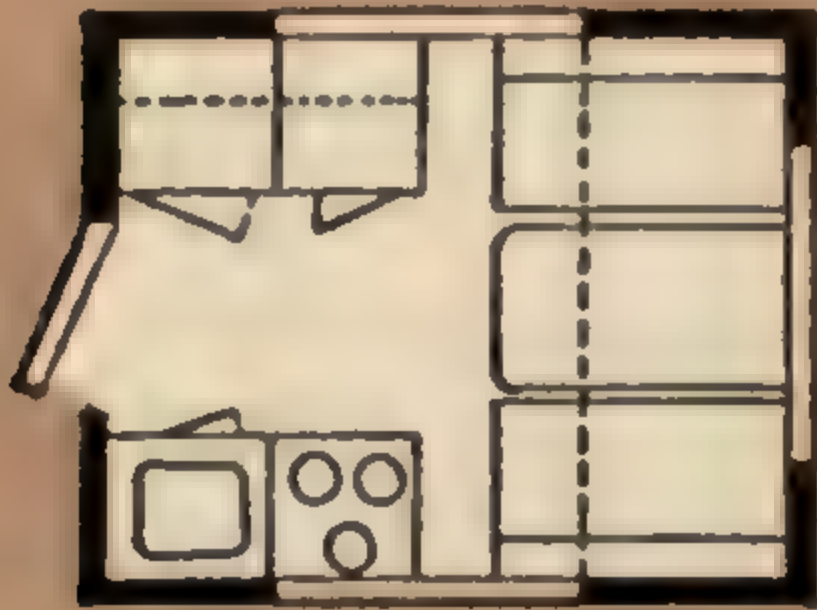
however, the slope's operators recommend using skis with tough plastic running surfaces.

Another artificial surface—vinyl fiber—was tried last year at Mt. Tom in Massachusetts. Bristles an inch and a half long are crimped into flexible, metal-based mats measuring four by six feet. At Mt. Tom enough of the honeycomb-pattern mats were put down to make a 280-foot strip down a practice slope.

In use in Europe for five years, the bristle mats can do year-round duty. In winter they can be used as "traps" for natural snow at points where there's excessive wind scouring or as a sturdy base in areas of heavy traffic.



CHASSIS-MOUNTED camper features side entrance with dinette in the rear. Double bed extends over the cab. Kitchen and cabinets line one side. Dinette converts to double bed, sleeps two adults



BOX-TYPE camper fits into bed of pickup. Door is at the rear. The dinette at the front folds into double bed. There is less interior space and storage, but it still contains fully implemented kitchen with gas stove, icebox and sink



REGULAR CAB-OVER extends beyond the truck bed about two feet. While it lacks the interior floor width of chassis-mount, it is still spacious and leaves the truck free for other uses when camper is unbolted and removed



Hit the Trail in a **Piggyback Camper**

What about comfort, cost, ease of handling? Where can they go? Owners reveal the pros and cons of their rolling vacation homes

By **Stuart James** PM Outdoors Editor

JUNE 1965

"I WOULDN'T HAVE ONE of those big cab-over campers," said Paul Douglas of Azusa, Calif., "—too cumbersome."

Ken Cochrane disagrees with Douglas. A mailman in Sacramento, Calif., with a wife and three sons, Ken owns a 10½-foot "cab-over" mounted on a Dodge truck.

"This is the perfect unit for a family our size," Ken said. "We have a complete

kitchen, plenty of storage, and the dinette converts to a bed for the boys. I'd say that the most convenient feature is the bed over the truck cab. It gives the interior a feeling of spaciousness and the boys can ride up there when we're traveling."

Both Cochrane and Douglas are examples of more than a million outdoorsmen in the United States who believe in mixing their wanderlust with an equal measure of creature comfort. Both have strong opinions about which type of pickup camper is best.

Douglas, who dislikes the cab-over type, owns a Pullman camper. This is a variation of the box-type camper that is principally a sleeping quarters. A large rear door is equipped with a folding table-cabinet, and a portable campstove is used for outdoor cooking. A metal canopy slides off the rear of the camper roof to provide shelter over the table and stove.

"I've seen those big, cab-over campers coming into campgrounds and banging into tree limbs," Douglas added, and I've heard stories about them getting jammed up in filling stations where there was a low roof over the pumps."

Other owners of pickup campers expressed different opinions, and we found that this was typical. Bill Wiggins of Roswell, N.M., for instance, felt that it was important that the camper coach be removable to free the truck for other uses. Warner Washburn of Highland Park, Ill., on the other hand, wanted more stability, so his coach is mounted directly on an extra-long chassis of a $\frac{3}{4}$ -ton International.

"It's a matter of personal taste and necessity," said Carl Marcus of La Crescenta, Calif. "I chose an Alaskan camper because the top can be raised and lowered with a hydraulic pump. I want the low silhouette for traveling. There's just my wife and me, so the one bed that unfolds from the dinette is sufficient."

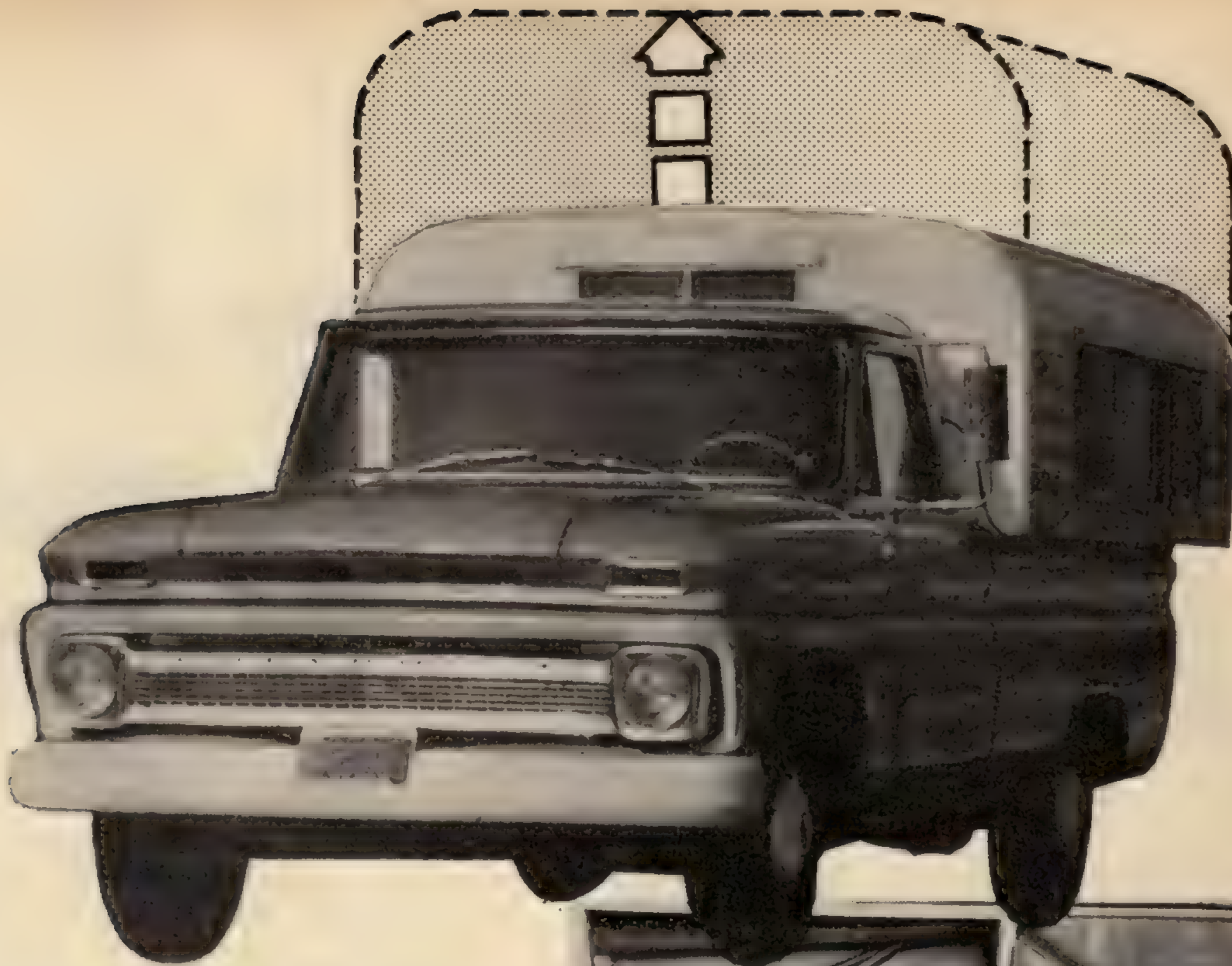
What's the Fuss All About?

Essentially, a pickup camper is a box mounted on the rear of a truck. There is nothing new about this, but these compact vacation homes on wheels have now become mighty luxurious. From a plywood box fitted with a pair of folding cots, these now resemble miniaturized house trailers.

There are three basic types: the box

VIEW FROM DOUBLE BED over the truck cab shows the interior spaciousness of a typical 10-foot camper on regular pickup bed. Butane stove runs off 20-gallon tank. Water for cooking and washing is pumped from storage tank





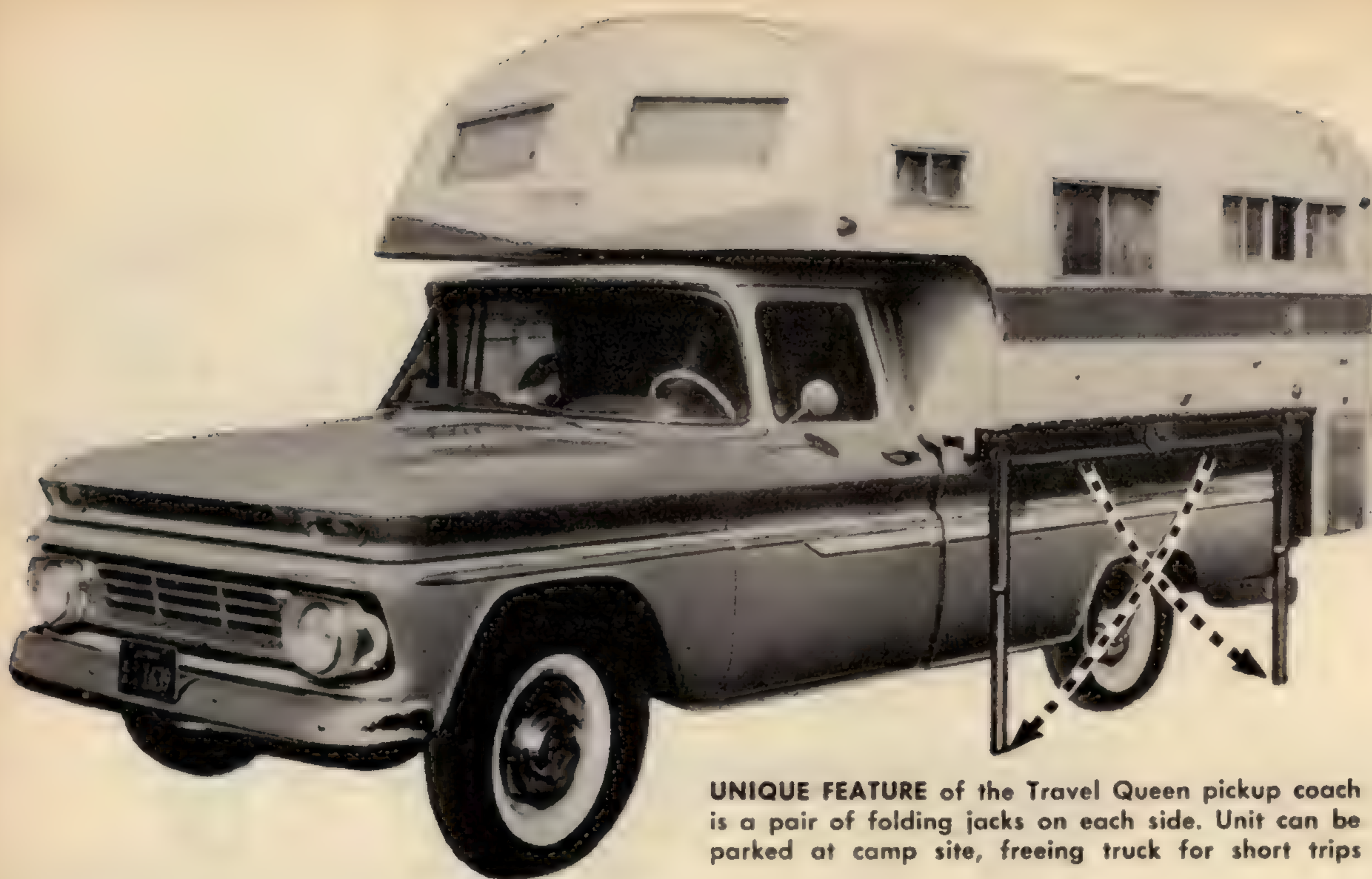
POPULAR AMONG TOURING COUPLES is the Alaskan. The camper top rides low for traveling, but is raised by a hand-operated hydraulic jack (inset) to give users ample headroom for eating and sleeping

SOME TRUCK CAMPERS feature an opening between the interior of the camper and the truck cab, enabling parents to maintain order with kids in the rear



WHEN DINETTE IS FOLDED into double bed, an average cab-over sleeps a family of five comfortably. The beds are six feet long, accommodating most adults





UNIQUE FEATURE of the Travel Queen pickup coach is a pair of folding jacks on each side. Unit can be parked at camp site, freeing truck for short trips

camper, the cab-over fitted in the truck bed, and the cab-over mounted on the truck frame. Photos on page 109 show typical examples of each.

The box camper slides into the truck bed and is limited to this area. It has limited headroom and sleeping facilities for two. The cab-over also slides into the truck bed, but it has a double bed extending over the cab, more than six feet of headroom, and with the dinette converted to a bed it will sleep four adults or two adults and three children. The cab-over mounted on the truck frame eliminates the truck bed, lowering the overall weight for greater stability. It is generally the full width of the truck, increasing the interior space.

With the exception of the box-type Pullman camper, all of these units are equipped with a three-burner gas stove, a sink with water hand-pumped from a storage tank, an icebox, storage cabinets and lights that operate off the truck battery. Many also contain an oven.

The extent of the interior space, the amount of storage and size of kitchen work area is determined by the size of the unit. Optional equipment on deluxe models can include a shower and marine toilet, air-pressure water system, butane refrigerator, hot water heater, intercom, thermostatically controlled space heater and a sun deck with ladder.

"The intercom is more a necessity than a luxury," said Ken Cochrane, "particularly if the kids ride in the rear. A stern word from up front keeps order when they get too rambunctious."

To facilitate communication between cab and camper, several models have an opening at the front the size of the rear truck window. The glass is removed from the cab window and a vinyl boot is installed to complete the connection.

Cab to Camper Walk-Through

Travel Industries, Inc. of Oswego, Kansas, makers of one of the most popular pickup coaches, the Dreamer, is now offering a customized unit in the chassis-mounted model that can be entered from the cab of the truck. The truck is equipped with bucket seats, and you enter the camper through a four-foot-square opening between the seats.

Although the pickup camper personifies the luxury trend in camping, there are some disadvantages to these units.

"There are always some parkways in the East on which these vehicles can't travel," reported a *PM* editor after taking a 10-foot cab-over model on a test run with his wife and three children. "I didn't find it a problem when we planned in advance, even though we could have taken a shorter and cheaper route had we been in a passenger car. But it is a problem if you

suddenly decide to switch destinations and then are not sure you can travel the route you want."

Wherever truck traffic is restricted the pickup campers will not be allowed. In almost all cases, according to the Trailer Coach Assn., these thoroughfares will be designated as "parkways" or "boulevards." Pickup campers are allowed on all expressways. In some areas, however, this simple logic can be confusing. In New York, for instance, they are not allowed on the Belt Parkway, but they are allowed on Bruckner Boulevard. Another example, the Garden State Parkway in New Jersey, is open to travel trailers, but is closed to pickup campers.

Any vehicle carrying bottled gas is prohibited from traveling through underwater tunnels such as the tunnels to Manhattan Island and under Baltimore Harbor. On bridges with two levels they are generally allowed on the top level only. The new Chesapeake Bay tunnel-bridge allows vehicles with gas bottles no larger than 20 pounds.

The only sure method of avoiding difficulty is to plan ahead and make advance inquiries. The highways division of a state and the traffic department of a city will give complete information on specific areas.

Living on the Level

Parking can occasionally be a rather difficult situation. When we first encountered Ken Cochrane, he was making the rounds of a crowded state campground, searching in vain for a level campsite.

He finally had to settle for a sloping spot between two campsites that left one side of the truck a good six inches lower than the other.

"This is when you wonder about owning a camper," he growled. Sending his three sons in search of flat rocks, he got out a heavy duty jack and began raising one side. An hour later the camper was level, the wheels of the left side sitting on two platforms of rocks.

"You only have this problem when you definitely want to camp at a specific site," Ken explained. "Otherwise you can just go elsewhere to find a place to park. It doesn't have to be a campsite. Everything we need is right in the camper. I will say, though, that these units must be parked level or you have a miserable time trying to sleep."

There are, of course, some restrictions on where you can park a pickup camper. It could be dangerous to merely pull off onto the shoulder of a highway, and in many states this is against the law.

"I've never had any difficulty," said Warner Washburn, who has made many trips from the Chicago area to Florida. "On most highways there are designated rest areas well off the highway, and if these are not available I stop at a service station to gas up and then ask the owner if I can pull around to the rear and spend the night. I've never been refused."

The Pennsylvania Turnpike Commission makes a point of suggesting that anyone stopping to sleep for the night do so in a designated rest area.

Self-contained units such as a pickup

(Please turn to page 184)

WALK-THROUGH OPENING between coach and truck cab is now available on chassis-mounted Dreamer Explorer. Equipped with bucket seats, the truck has the rear of cab cut out and fitted with a vinyl boot



JUNE 1965



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Slot Racers' 8-Lane

WIDE OPEN, the tiny cars sound like so many hornets out for blood. They tear down the straightaway at actual speeds of 60 mph and slam into sharply banked curves.

This is no playroom setup. It's a commercial track for slot racers recently opened in Van Nuys, Calif. The eight-lane track is 408 feet long and has 70-foot straightaways, 12 high-speed curves (one of them backed 38°) and downgrades as steep as five percent.

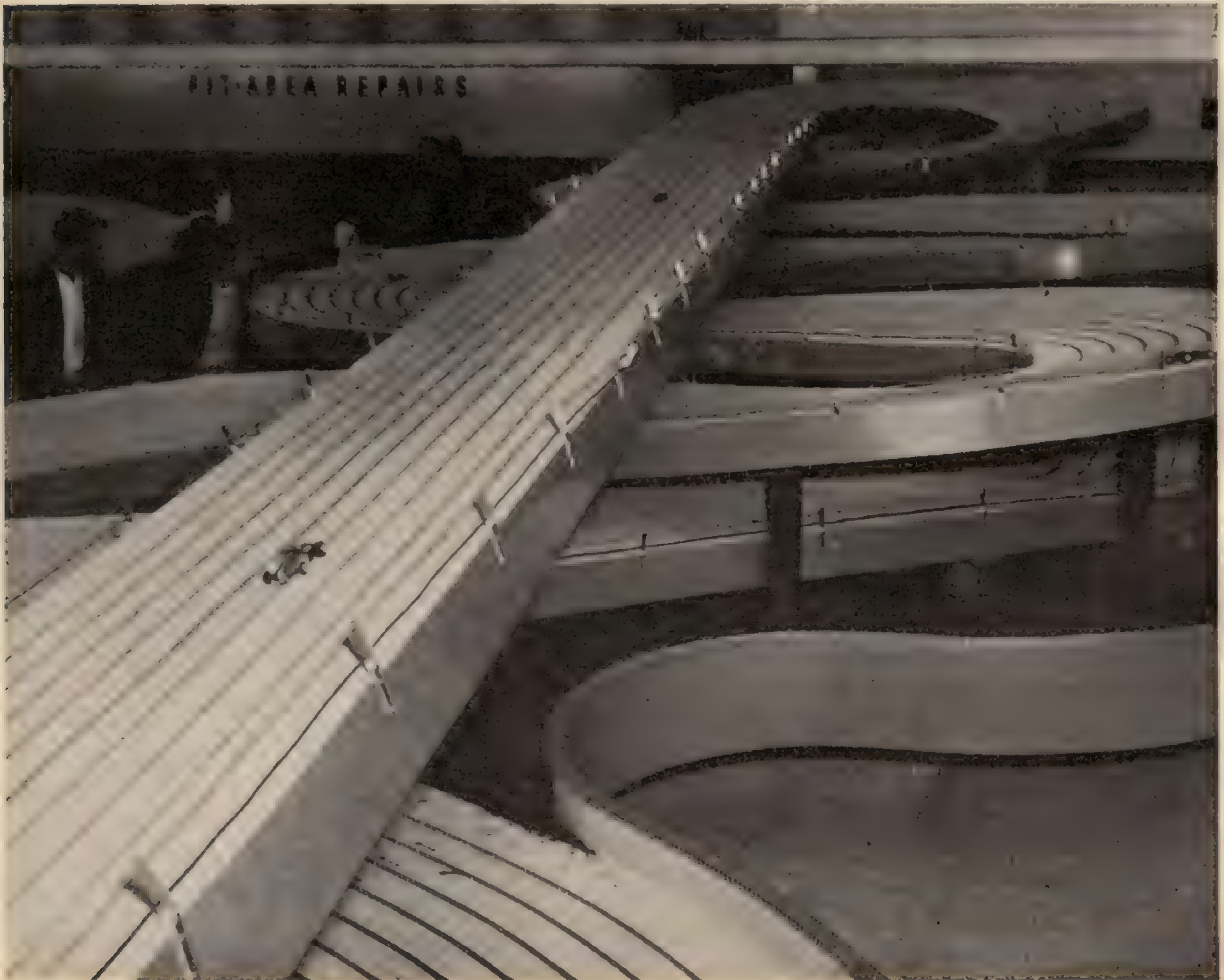
This Indianapolis of slot-car racing calls for skilled throttle work. Experienced buffs, operating from eight power-control stations, can whip their cars through a circuit of the track in 25 seconds.

Customers pay 50 cents for a half hour's racing. The fee includes "pit" privileges and the use of a bench equipped with a 110-volt outlet for soldering. Other big-league touches are automatic counters that register each car's laps during competition and six-inch-high Plexiglas guard rails at curves.

"When a 1/24th-inch-scale car careens off one of our eight-foot-high curves," says the track's manager, "it's like a real car plunging 192 feet."

Power braking is also built into each lane. When a driver releases the throttle of his control unit, the motor on his car shorts out, which automatically brakes its wheels.

MODEL CARS ARE GUNNED to 60 mph on straightaway. The 400-foot turnpike is laid out on four levels—the top one is eight feet above the floor—and has a dozen sharp turns to test handling skills. It's surfaced with Formica



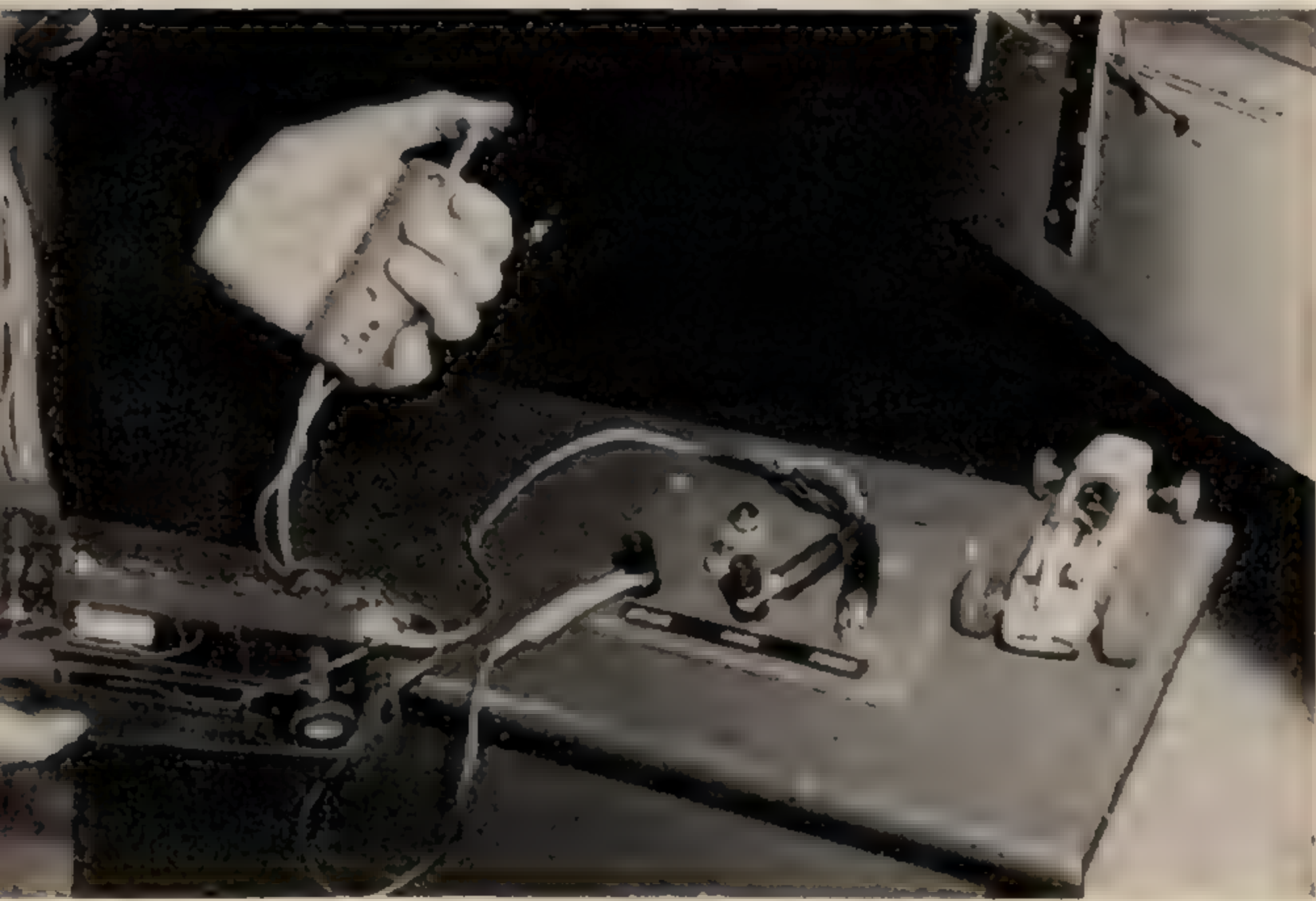
Turnpike

"Braking is used competitively," explains the manager. "A driver can whip his model fast into a curve, brake momentarily, then sideslip through without skidding the car out of its groove."

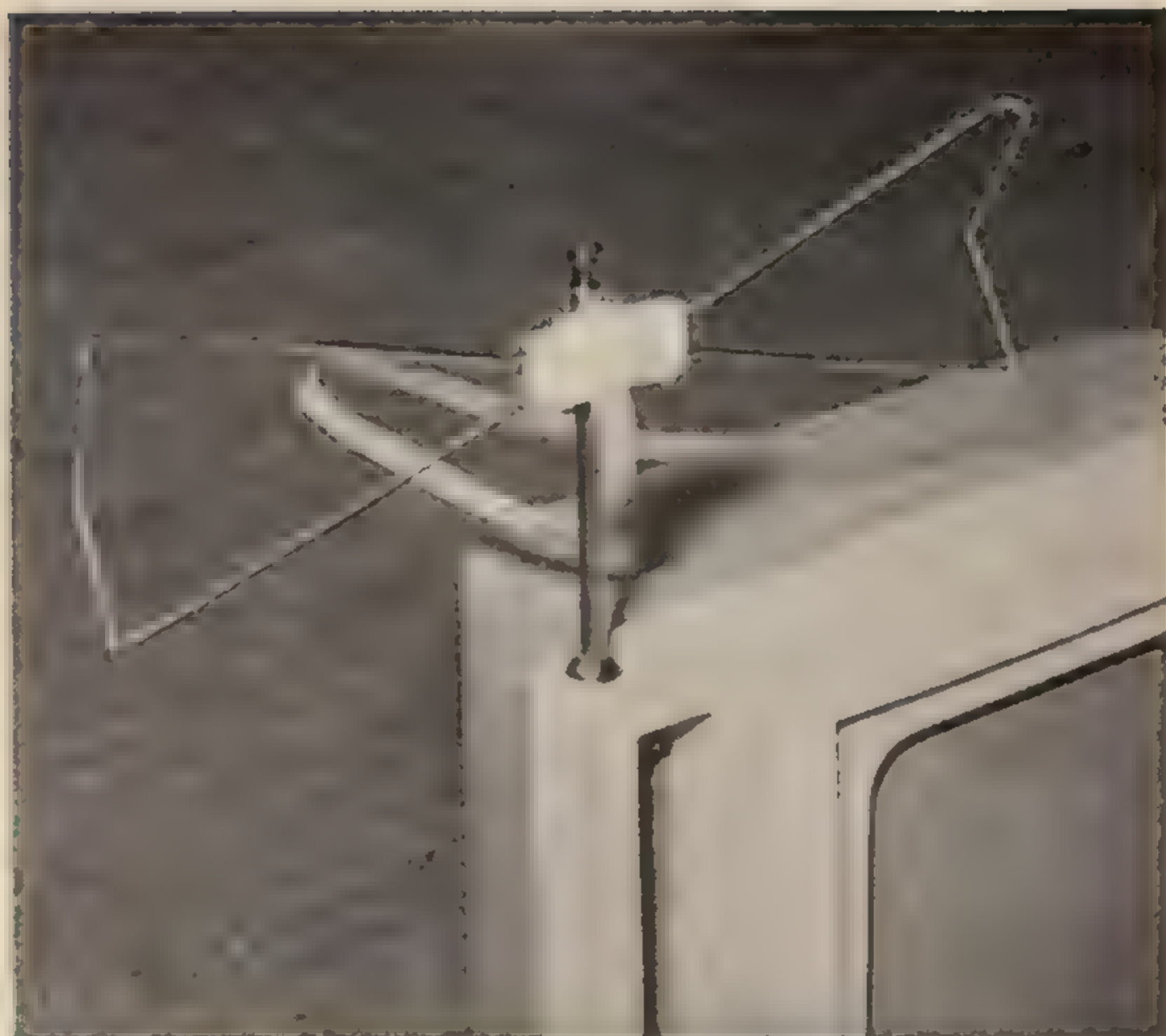
The main turnpike is flanked by a couple of practice tracks. One of them is a 55-foot dragstrip on which models can be gunned up to 100 mph (actual speed) from a standing start. As the cars break photo-electric beams at the finish line, markers—1st, 2nd, 3rd—light up over each of the three lanes.

It's small wonder that model buffs come from as far away as 400 miles to test their cars—and their "driving" skill—on this big little turnpike.—*James Joseph*

PLUNGER-TYPE RHEOSTAT control provides variable power. Lanes carry 18 volts d.c. and can be switched in polarity to fit electrical hookup of any car

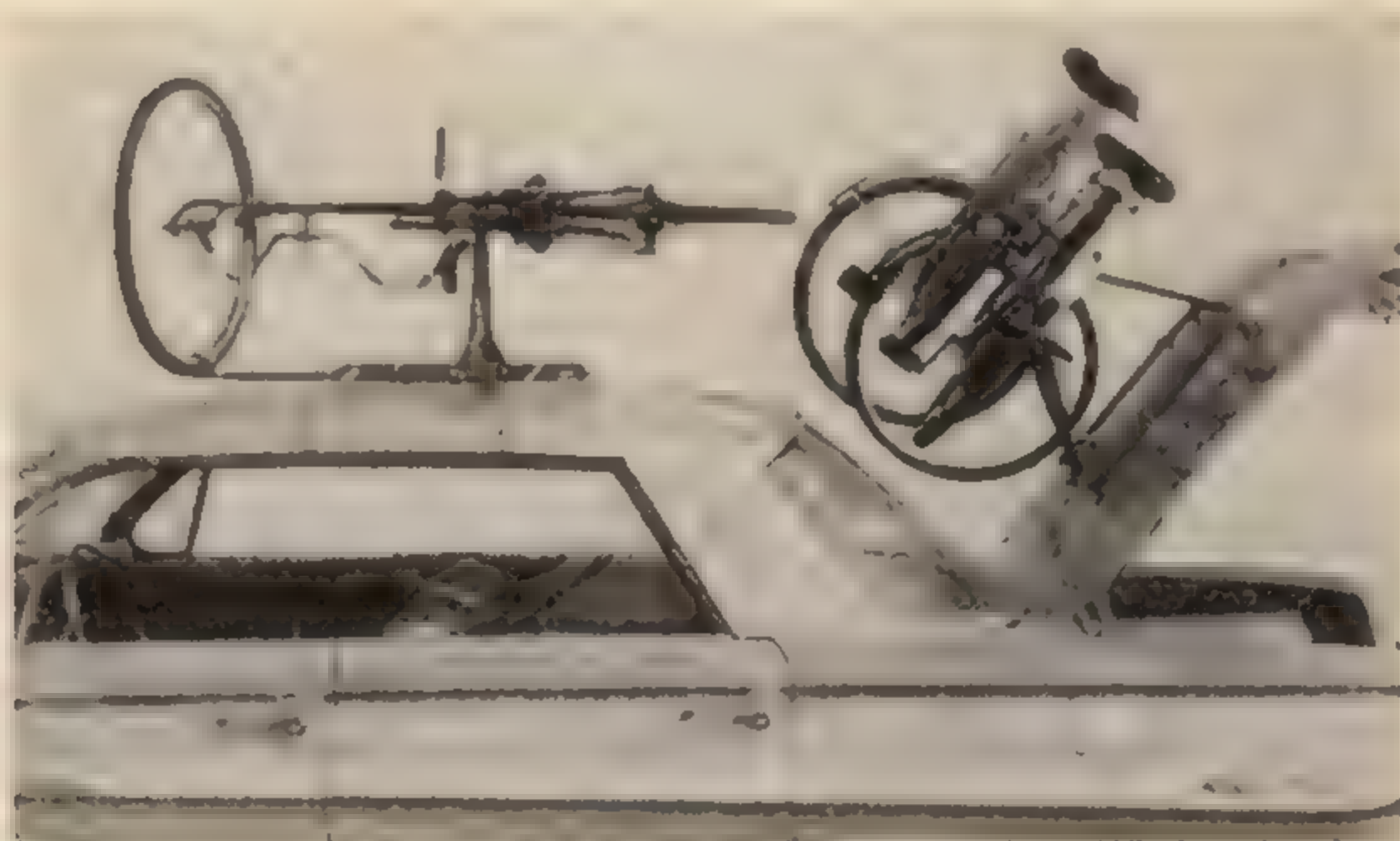


SPECIAL RETRIEVERS, five feet long and with jaws padded with sponge rubber, are used to pick up cars not easily reached by hand. It's a huge layout



TV Portable Sports a Bow Tie

When you tune this 12-inch Motorola Cadet portable to a UHF channel, simply clip the special UHF bow-tie antenna on standard VHF stick (top). During VHF viewing it clips on rear of set. Rod antenna folds into handle.



Car-Top Bike Toter

Bicycles can be carried on auto trips without taking inside space by use of a roof or trunk carrier. One-bike model is \$17.95; two-bike, \$24.95; Franklin Imports, 106 W. 81 St., New York.

New for Your Home



PLANT FOOD BRIQUET continuously fertilizes potted or garden plants for six months. Place briquet at plant base; premeasured nutrients are released when plant is watered. Box of 60 costs \$1.29 from Loamite Div. of Pope & Talbot, San Francisco, Calif.

GARDEN TOOL snap head lets you use one handle for 17 tools. Head and handle lock together with an Allen key; guide slots insure correct mounting. Handle is \$1.59 and heads (from hoe to wheeled turf edger) start under a dollar. By Gardex, Inc., Michigan City, Ind.



TUB-SHOWER DOOR slides and folds out of the way when not in use. Shatterproof plastic unit takes 30 minutes to install, gives complete splash protection. Tub track, trolley rail and door cost about \$55 (towel bar optional). By Tub-Master, 409 Virginia Dr., Orlando, Fla.

MECHANICAL SOFA becomes a chaise longue (as shown), a 3-seat couch or 80-inch-long bed. Working like an airplane seat, a handle controls friction lock inside the back frame for desired position. 3-in-1 units start at \$160. Kroehler Mfg. Co., 666 N. Lake Shore Dr., Chicago, Ill.



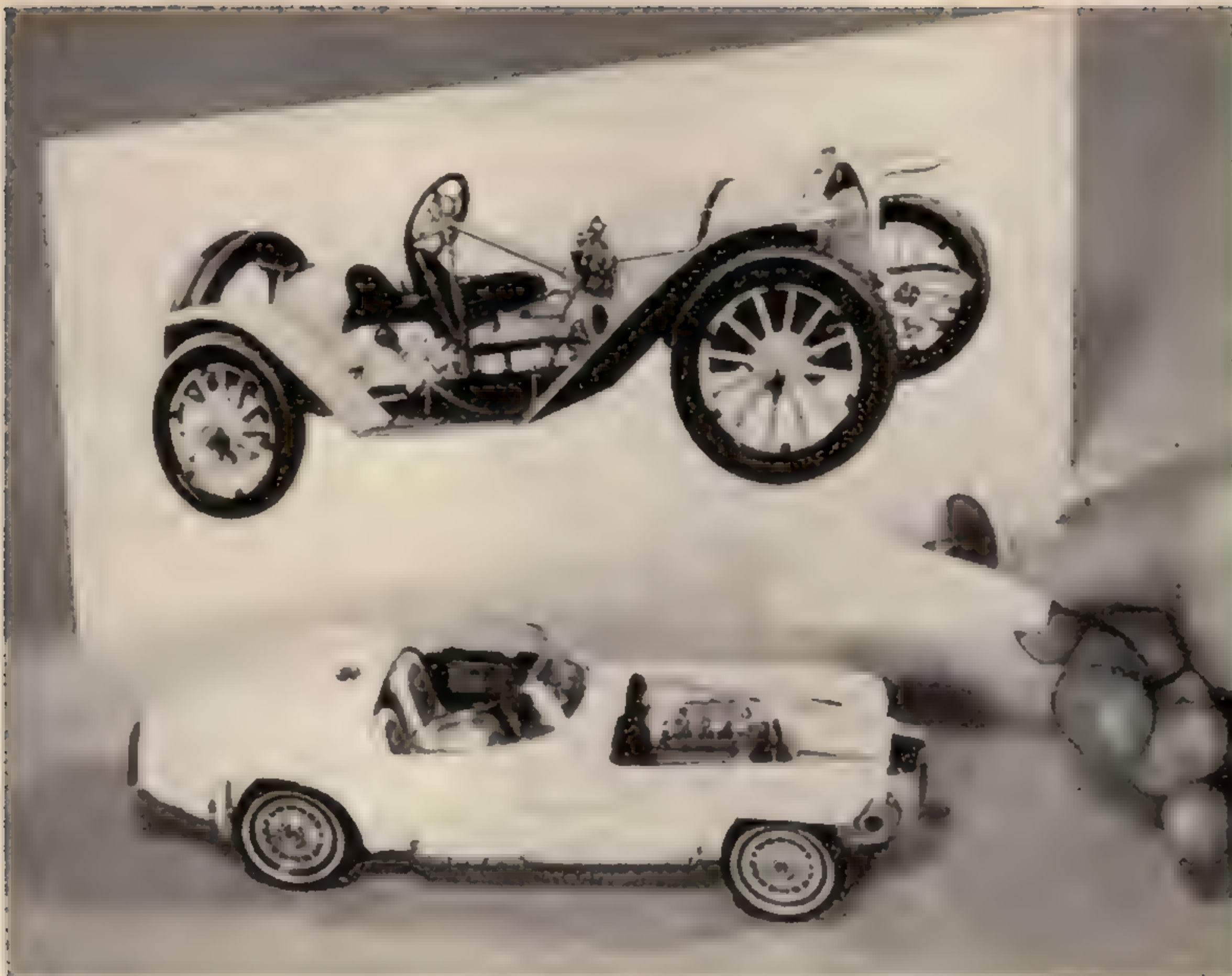


LAUNDRY TUB is wall hung, mounts quickly to steel bracket on any type of wall. Molded, finely ground stone with resins and fibers forms the material which is 80 percent lighter than concrete, and stain, rust and mildew-proof. The sink holds 20 gallons, supports up to 600 pounds. Price of single tub, \$25; double tub model, \$50. Fiat Metal Co., Michael Ct., Plainview, L.I., N.Y.

AUTOMATIC TELEPHONE DIALER with interchangeable cartridges holds 400 or 1000 numbers. Calls can be made at the touch of a button. Names and numbers are visibly indexed and recorded in unit. Installation costs \$15. Developed by Bell Telephone system.

ENAMEL SPRAY resists high temperatures, coats and protects grills, water heaters, furnaces and clean outboard and auto engines. In black or aluminum, it dries overnight. Price of 16-oz. can is \$2.19. Made by Martin-Senour Paint Co., 2500 S. Senour, Chicago, Ill.





Old Name, New Car

Have you seen the 1966 Stutz or Mercer?

They do exist. So do '66 models of Packard and Duesenberg.

The famous old names appear in a "Revival" series of 1/25-scale, \$1.98 kits by Renwal.

Contemporary versions of four well-known old cars have been developed like the model Mercer (left) based on the 1911 Raceabout (in back).

Silent Sculling

Using just one hand, a fisherman can scull his boat silently along with a canoe paddle clamped in a new transom attachment.

By a one-hand movement on the paddle, the boat is moved forward, reversed, and turned. A pivot arrangement feathers the blade automatically.

The Rocker-Lock is available for \$39.75 from Kitchen and McClay, 29 W. Bank St., Petersburg, Va.



High-Wire Act

Trucking a convoy of giraffes across the wide-open spaces of Africa can have its problems.

Low-hanging telephone wires are a hazard to the long-necked animals—and it takes a game warden with a long pole to hoist the wires out of the way at times.

These giraffes were recently traveling from Eastern Transvaal to a Zululand game park.

PM SHOPPING GUIDE

TRY ALL THE ADJUSTMENTS before you buy. Here a shopper adjusts the right eyepiece of a lightweight, wide-angle glass. This 18-ounce binocular is 6 power, gives a 630-foot field of view at 1000 yards



WHAT TO LOOK FOR IN BUYING BINOCULARS

What about power, field of vision, exit pupil size, balanced barrels? Can you spot a phony? Here are before-you-buy tips you should know

By Ken Warner

THE IMPORTANT DATA about any binocular appears in one line in a catalog:

7x35 C.F. (425 ft.) 22 oz. \$87.00

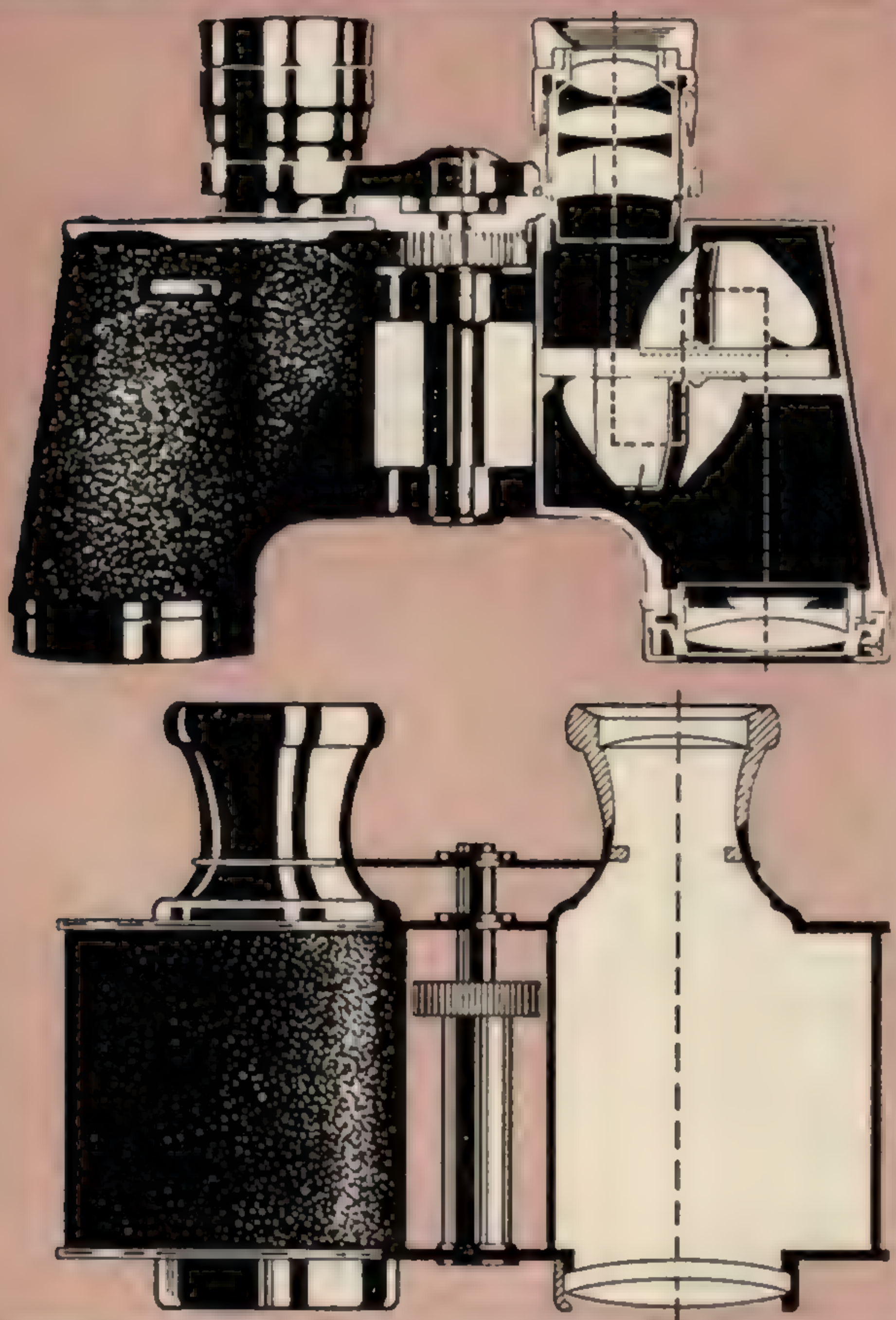
Literally translated, this binocular magnifies seven times, its objective lenses (the ones in front) are 35 mm in diameter, it has central focusing, gives a 425-foot field of view at 1000 yards, weighs 22 ounces and lists at \$87. What do these specifications mean in terms of performance? Let's take them one by one:

Magnification: This merely expresses the "power" of a binocular to enlarge an object. A 7X glass brings an object 700 feet away to only 100 feet away.

Objective diameter: This determines the size of the exit pupil and, therefore, the brightness of the scene. The pupil is seen as a round, lighted spot on each rear (ocular) lens when the binocular is held away from the eyes and pointed at a bright surface.

The entrance pupil of the average human eye varies from 2.5 mm on a bright day to a wide-open 7 mm at night. At dusk, it's around 5 mm. So, for most binocular viewing, a 5-mm exit pupil is a good average. To find the size of the exit pupil, divide the diameter of the objective lens by the power of magnification. Thus, 7x35 binoculars have 5-mm exit pupils.

Focus: There are two kinds of focus-



HOW TO SPOT A PHONY: Drawing at top shows how objective lenses of most prism binoculars are offset to accommodate prisms. Low-priced Galilean fakes (bottom) resemble binoculars, but have no prisms

ing arrangements on modern binoculars. *Central focus (C.F.)* types have a wheel on the center hinge to focus both oculars. Turning the right eyepiece adjusts for differences between the user's eyes. On less convenient *individual focus (I.F.)* models, you focus eyepieces separately.

Field of view: This is the diameter of the scene viewed. Most often, it is expressed in feet or yards at 1000 yards. A wide field of view is desirable and, in "normal" glasses, marks a superior optical system. But this doesn't apply to wide-angle binoculars. When a normal 7x35 glass might have a field of about 400 feet, wide-angle types will show over 550 feet. Some go to about 650.

In practical use, a field approaching 400 feet is quite usable. Wide views are especially useful at close range, such as in watching a play or indoor sports like basketball and hockey.

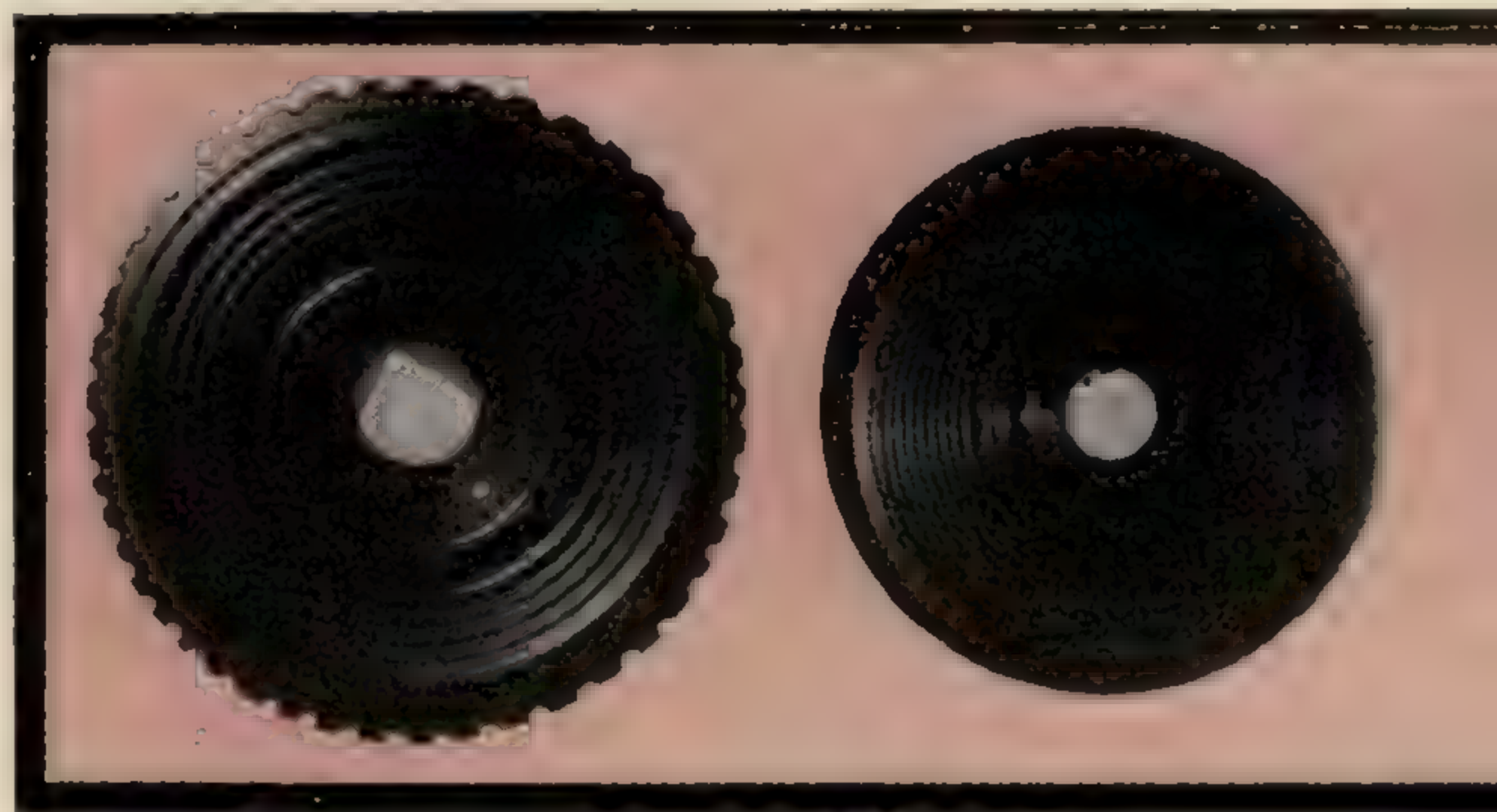
Weight: Binocular buyers often ignore this factor, to their later regret. An instrument weighing 24 ounces may seem light

in the store, but add the case plus ten or more pounds of hunting or camping gear and it becomes a heavyweight. On the other hand, binoculars bought to use from a boat or car, or for spectator sports, may be as heavy as they need to be.

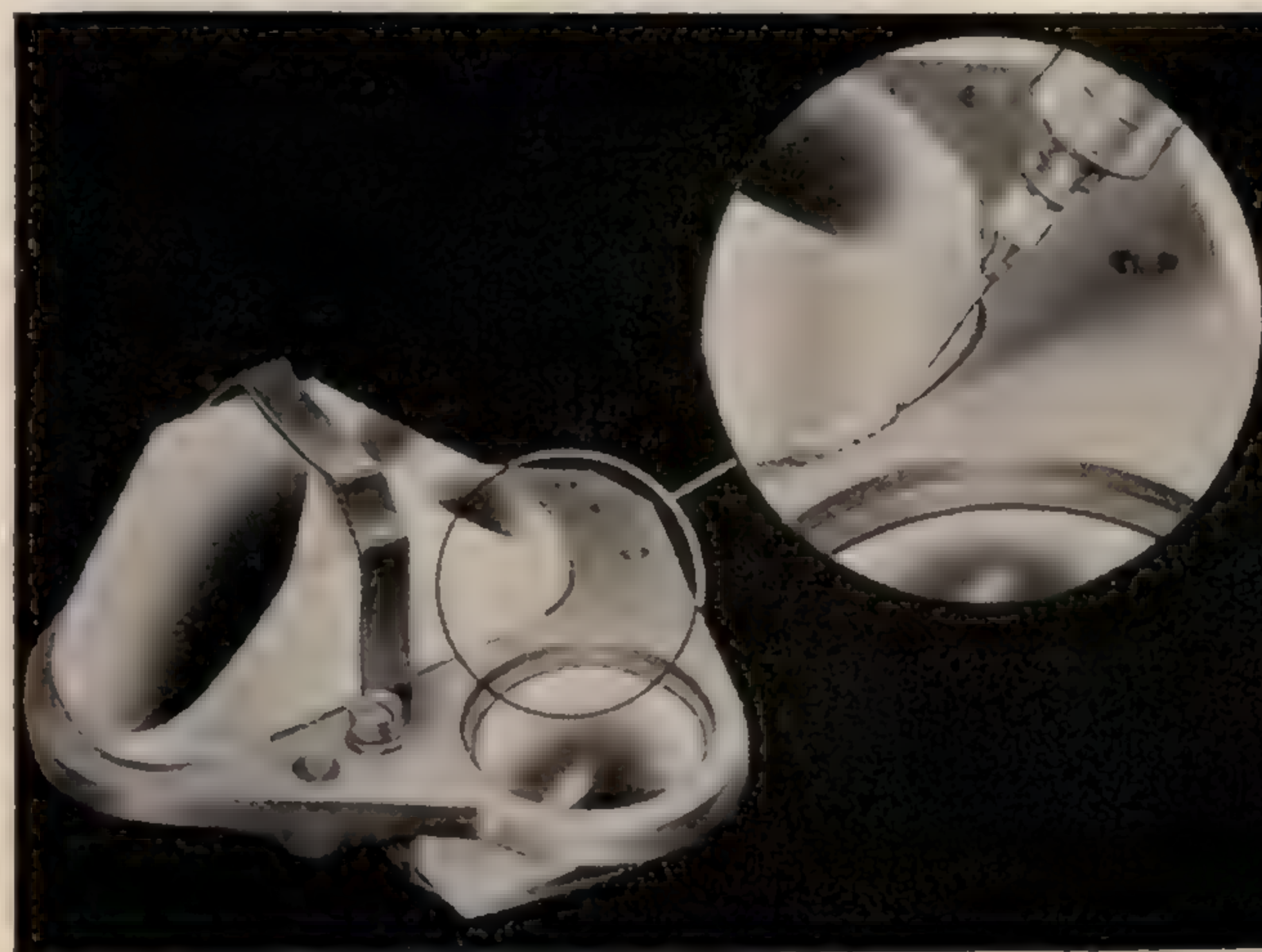
Price: Binoculars of approximately the same description may range in price from under \$25 to over \$200. Unfortunately, though, price is not a good standard for evaluation. True, a \$200 instrument from one of the old-line optical firms will be a fine glass likely to outlast the buyer. There isn't any argument on that score. But low to medium priced binoculars are quite serviceable for average use, provided they pass the inspection detailed later. The exception to this is where failure of performance might result in damages or hardship more costly than the price of a top quality binocular.

Almost all binoculars are discounted somewhere. However, if you must resort to mail order for a discount, be wary.

INADEQUATE PRISMS in binocular at left show as gray shadows in the exit pupil. Exit pupil of the good glass at right shows as a clear, well defined circle



IN BEST METHOD for mounting prisms, small metal strap over prism holds it in a recessed shelf. Injection of plastic fills gap between the prism and recess



Many binoculars examined for this article arrived defective, damaged or out of alignment. So, deal only with firms giving a no-questions-asked, money-back guarantee.

Which Binocular Is Best?

The reason most binoculars are 6x30, 7x35 and 8x30 or 40 is that these numbers represent the most practical combinations of portability, magnification, field of view and light-gathering ability. The 6x30 is light and portable. The 8x30 or 40 types, with higher magnification, give a smaller field of view but are better at picking out long-distance detail. The 7x35 splits the difference. When you come right down to it, the average buyer can't go too far wrong in choosing a quality glass in any of these categories.

A hunter using his glass to find game doesn't need a lot of power unless he's in the Western mountains. (And there, because of the long distances, he may be better off with a spotting scope.) A bird

watcher, on the other hand, can use and appreciate every extra bit of magnification to help identify tiny birds.

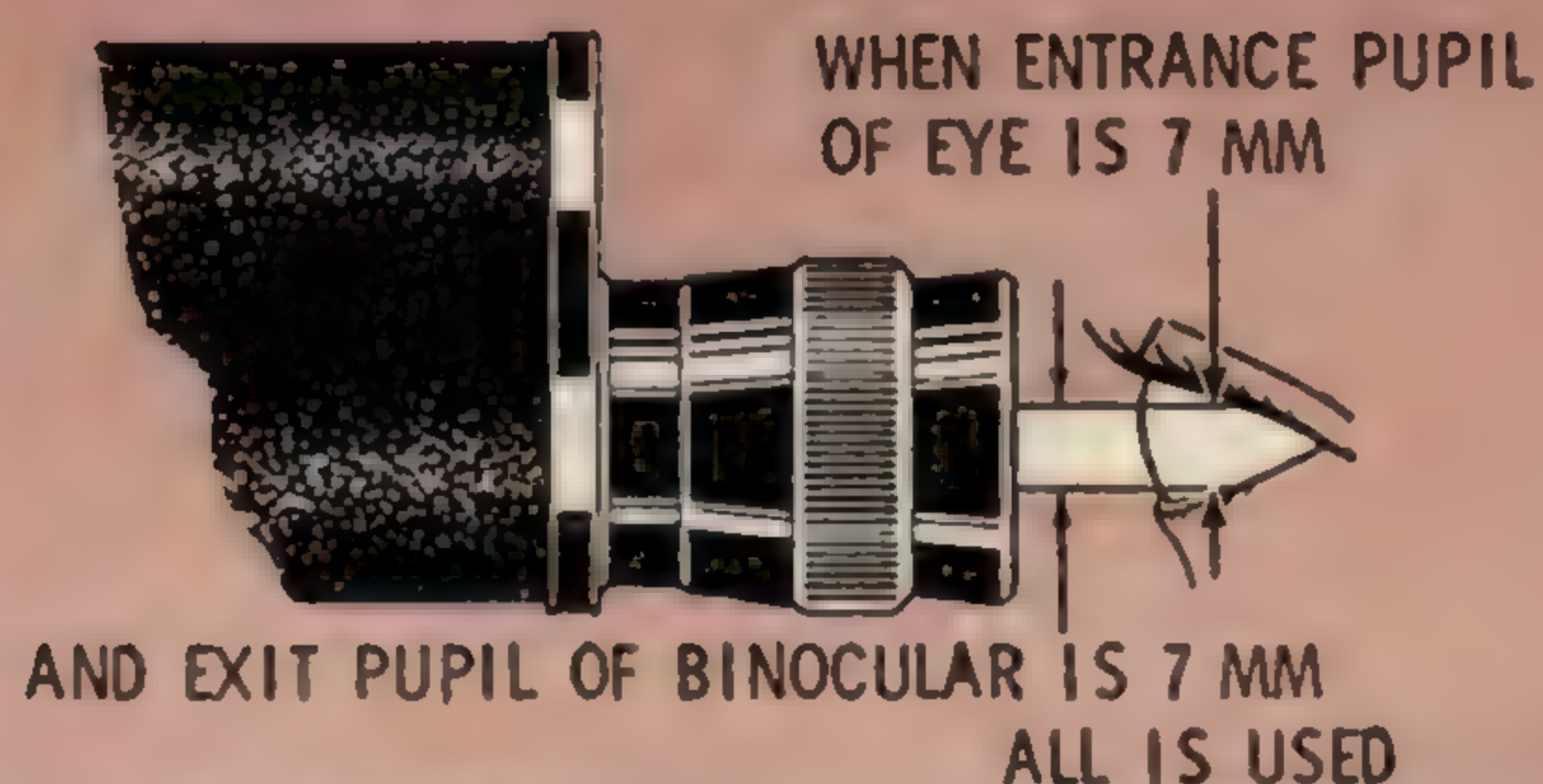
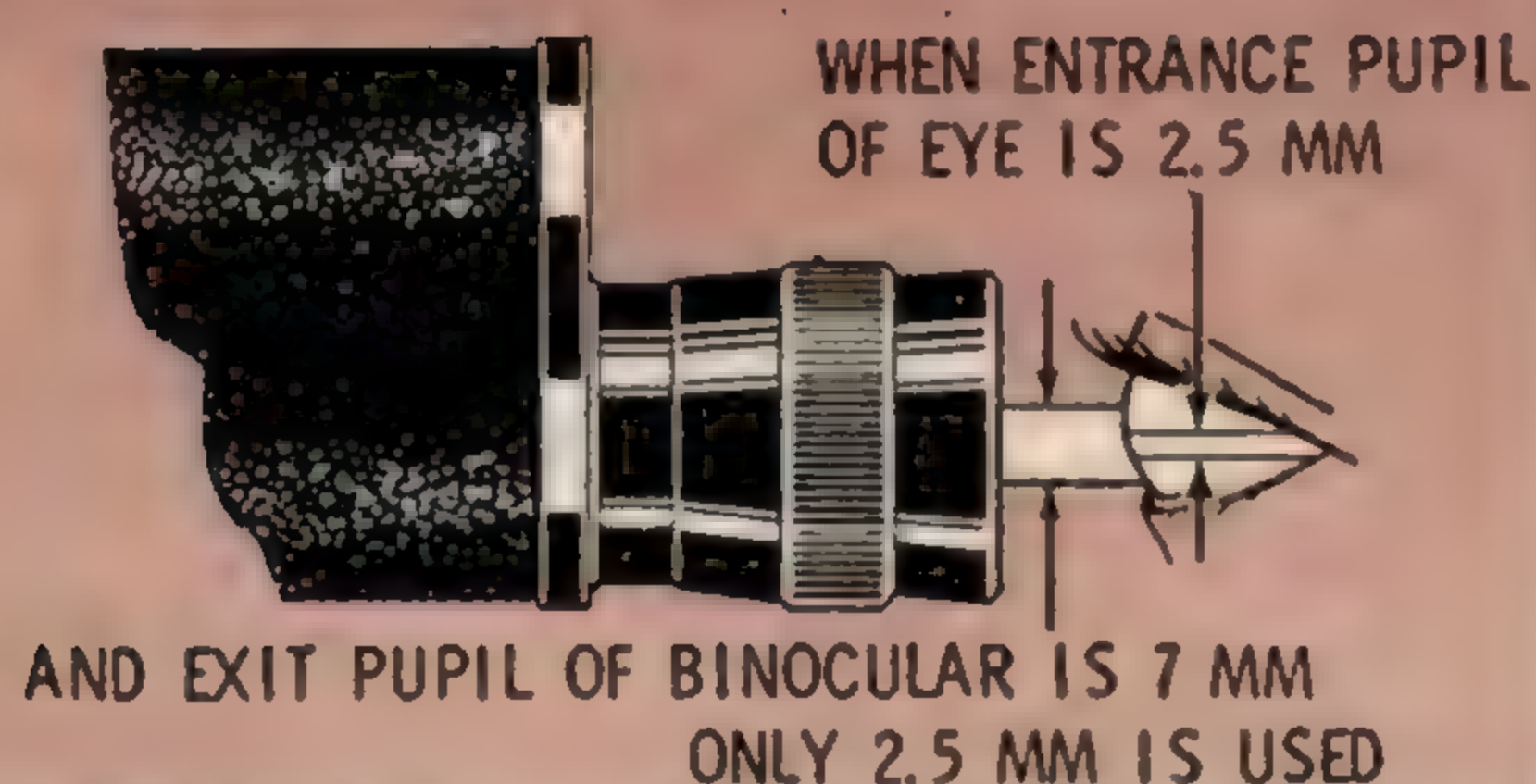
In the big-eyed night glasses—the 7x50s and 8x56s—the 7-mm exit pupils let you keep on seeing through dusk. Also, they are easily aligned with your eyes, even in dim light, while on a bouncing deck or in a moving car.

A buyer on a tight budget should note price differences in binocular patterns. The German or Zeiss style has two-piece barrels. In each barrel, a prism is mounted in one casting and an objective lens in the other (which is screwed into the first casting). The American or Bausch & Lomb style uses one-piece barrels, streamlined and fitted to the shape of the inside parts.

The German pattern is lighter and less expensive to build. The American type is stronger, provides a better seal against dirt and weather, and usually permits a wider field of view.

In the middle price range, German pat-

IN NIGHT GLASSES, large 7-mm exit pupils correspond to diameter of the eye's entrance pupil in the dark (drawing, right). However, constriction of eye pupil due to age of viewer or bright light (left) limits that advantage



LOOK DOWNWARD through objective lens to determine quality of body castings, method used to mount prisms. Here, screws of prism mount are clearly visible



INTERIOR OF SHODDY GLASS shows prism held down by single levered-in strap, roughness in casting (arrows), lack of anti-reflecting paint near prism



terns are about \$10 cheaper than equivalent American models. When you consider that I.F. models run about \$3 to \$10 lower than C.F. models, it's easy to see that a \$50 German-pattern binocular with individual focus can be a better buy than a \$50 American style with central focus. More money is going into the optics.

It's also worth noting that *prismatic* binoculars are the only kind to buy. There are opera glasses and field glasses with magnification up to about 5X. These instruments, which use the same principle as the telescope Galileo designed over three centuries ago, are adequate for theater use. However, they are sometimes made with phony, binocular-like bulges and illegally represented as binoculars (see sketches, page 120). While they may be described as 7x35 or 7x50, their fake bulges do nothing for performance.

How do you spot these phonies? Look for eyepieces and objective lenses to be in line with each other where the price tag runs \$20 or less.

In true binoculars, objective lenses are offset from the ocular except in Leitz Trinovid and Zeiss Hensoldt Dialyt models which are specially designed to permit straight tubes. This arrangement permits incorporation of the prisms which give binoculars their optical advantages.

Some pocket-type prism binoculars have the offset toward the center, putting the objectives closer together than the eyepieces. But most instruments spread the objectives apart, in order to create a stereoscopic effect.

How to Spot a Good Glass

When the salesman hands you a binocular, don't pitch it up to your eyes and look *through* it. Look *at* it first. Check the markings on the eyepiece end to see that they jibe with the catalog description and with what the salesman says about power, objective lens diameter and field of view. Examine all sides of the instrument for nicks, dents, loose leather or other damage. Make sure each screwhead is factory-new and free of burrs.

Next, check mechanical function. Serious flaws can be found this way: Flex the lens barrels slowly back and forth on the center hinge; they may be somewhat stiff, but they should move smoothly. On center-focus models, spin the center wheel slowly through its entire range of move-



EXCESSIVE DISTORTION is evident in this glass. Note how image blurs and vertical and horizontal lines are being twisted out of shape to the point where this instrument is useless

ment, feeling for mushiness or hitches and drag. On individual-focus types, run both eyepieces back and forth; do the same for the right eyepiece on center-focus models.

All these adjustments should come to a positive stop at each end of their movement. There should be no crackling noise—an indication that a heavy pack of grease has been used, perhaps to conceal poor fit. It should take definite force to move each adjustment. Any that moves too easily when brand-new will be downright sloppy after earnest use.

If there is anything wrong at this point, ask for another binocular. The next pair, even of the same brand, can be all right.

Now, return all adjustments to zero and tilt up the objectives to look down into the barrels. Hold them so they reflect an overhead fluorescent light and count the reflections. Every white reflection is an uncoated lens surface; dim amber or blue reflections are coated surfaces. Some uncoated surfaces are present in all instruments, but the presence of just one or two coated surfaces with the rest showing white means you may get a dull image with little contrast.

Then, either in sunlight or right under a strong light, look down into the barrels diagonally. In some brands, all that is visible is an inner non-reflecting tube and further examination is impossible. Most brands, however, including the best makes, do not use this tube and some of the in-



IN GLASSES SUFFERING from curvature of field, focusing the center of the image throws edges out of focus (left, above). When you try to focus edges (right), center will become fuzzy. While a slight curvature is easily tolerated by most users, a severe case is grounds for ruling out the glass

terior construction is visible. If so, look for, three things:

First judge the quality of the body casting by the smoothness of its interior. A sloppy wall with dabs of thick paint indicates a poor casting; a clean, smooth wall generally means a good casting.

Second, check the prism positioning. You see one side of a prism as you look diagonally toward the center of the binocular. It is vaguely house-shaped and sits on a shelf. Around its edge on the shelf is the positioning device. In a really cheap binocular, this can be just wax or plaster poured around the prism. Most common in low and medium-priced binoculars is peening—a steel punch is used to hump up parts of the prism seat to secure the prism. These peened spots are easily seen. Good binoculars should show one of three prism-positioning methods: A tight-fitting collar held down with screws; a triangular wire tight-fitted inside, adjusting screws; a clean job of spotting plastic around the prism.

Third, check the prism retaining strap. In all binoculars, this is roughly the same. There is a metal “roof” over the prism itself, and a metal strap runs over this, held down by a hefty screw into the prism shelf. The “roof” should fit neatly; the strap should be quite sturdy; the assembly clean and solid-looking.

These things are important for very practical reasons. A clean body casting

doesn't require any filler material which can break loose and float around inside the binocular. Sound prism-mounting is vital since a shift of a thousandth of an inch or so can give trouble. Peening, though it is used in most binoculars now on the market, can put a strain on the prism, making it more subject to damage from later shocks. A binocular with peened-in-place prisms should not bring a fancy price.

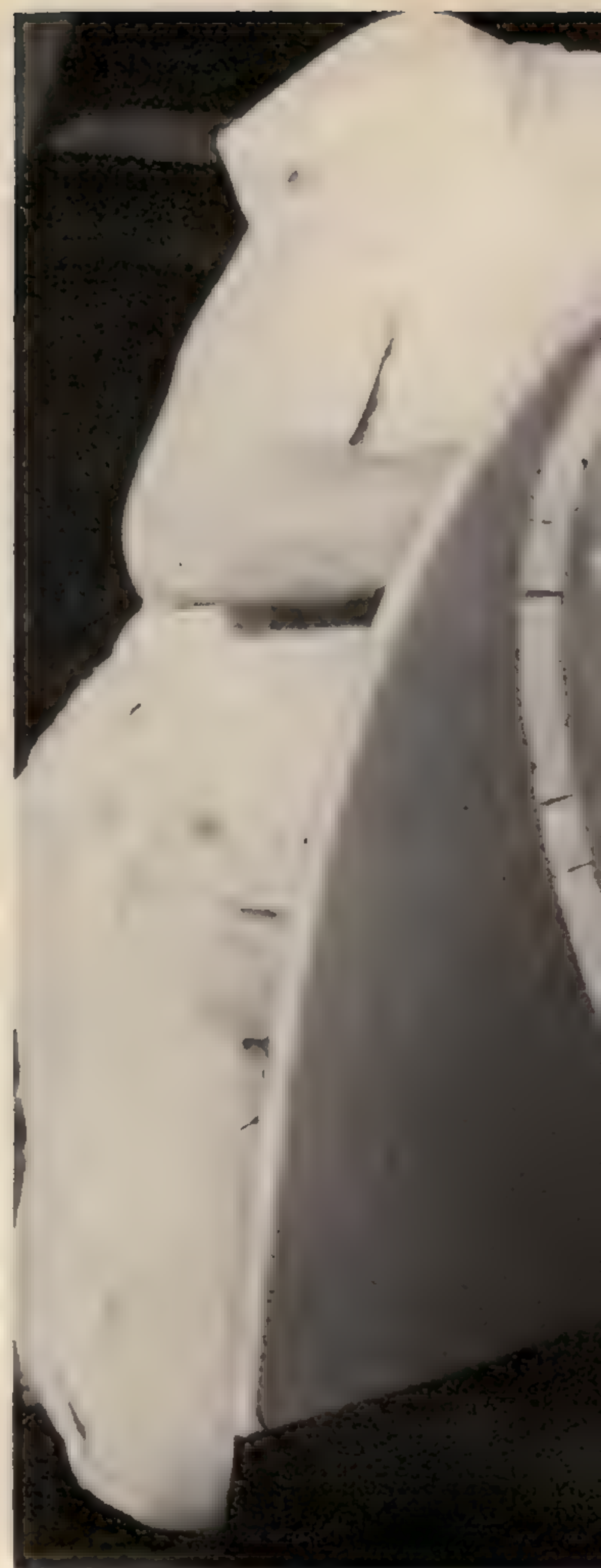
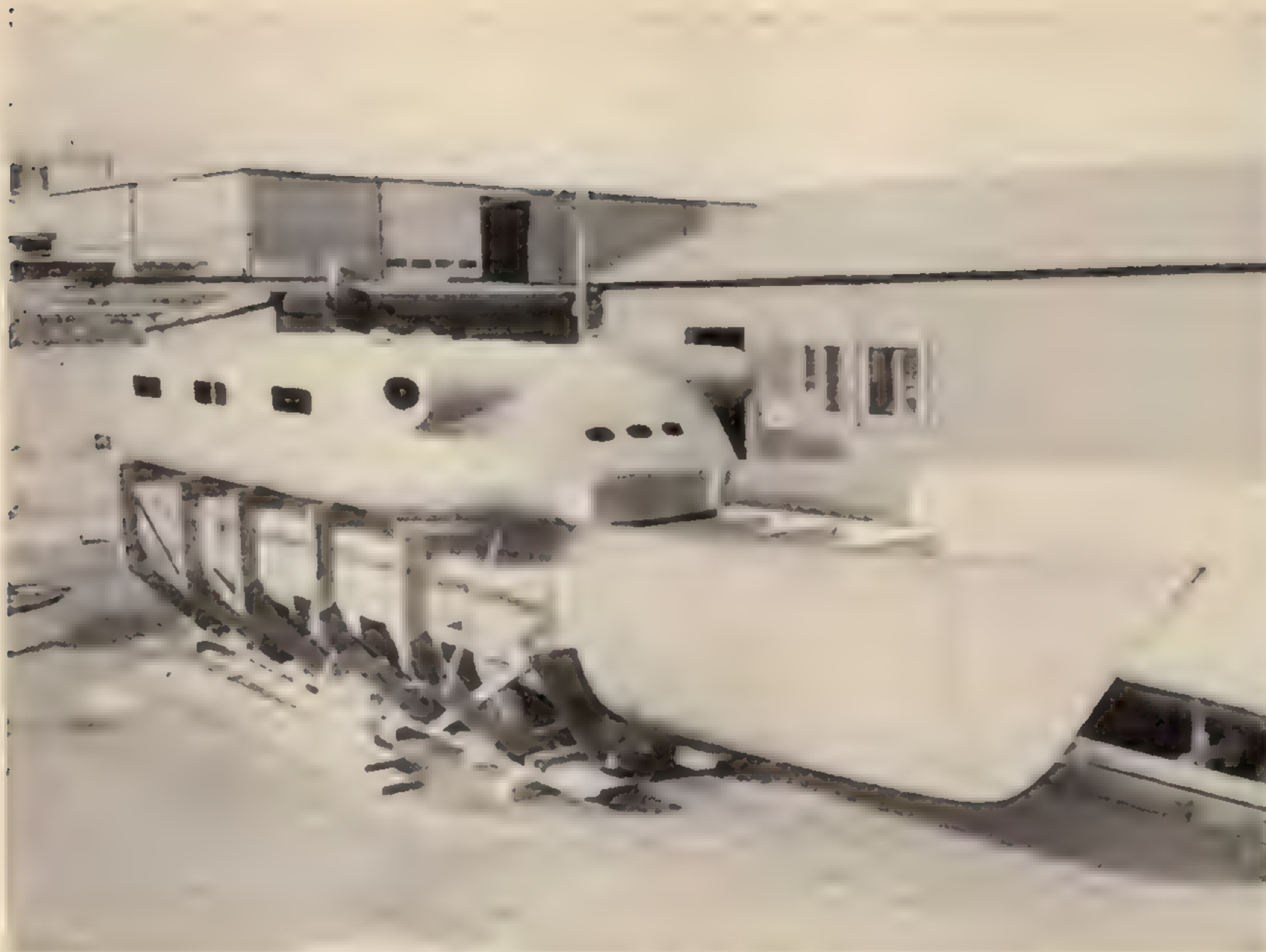
What About Square Exit Pupils?

Now point the binocular at a large, bright object and examine each exit pupil, which appears as a bright circle on the ocular lens. It should be clean and bright to its edge. Most medium and low-priced binoculars, however, show an exit pupil that appears to be a bright square in a gray circle. If the squares are the same shape, size and position in both exit pupils, this is not so bad. It indicates a skimpy prism, either in design and size, or in the use of inexpensive flint-type glass replacing the barium glass of better prisms. But the binoculars can still perform.

If the squares are not alike, the prisms are out of line and the binocular needs complete refitting. Don't buy it.

Prisms in wide-angle binoculars, incidentally, by their basic design, eliminate this test. Surrounding the exit pupil in these models you'll see a series of dim squares. They are normal.

(Please turn to page 180)



Sandwich Hull Is Built Without Molds

That sleek trimaran on the opposite page is the first boat to be built from a new fiberglass-foam sandwich material which can easily be formed into compound curves without using expensive molds. The secret is in the foam, a thermoplastic vinyl foam sheet which can be formed to the required shape on rudimentary forms using a heat blanket or infrared lamp. It's then coated with resin and fiberglass. Plyfoam, the core material, is from Potter Marine Products, Inc., Box 68, Plainview, L.I., N.Y.

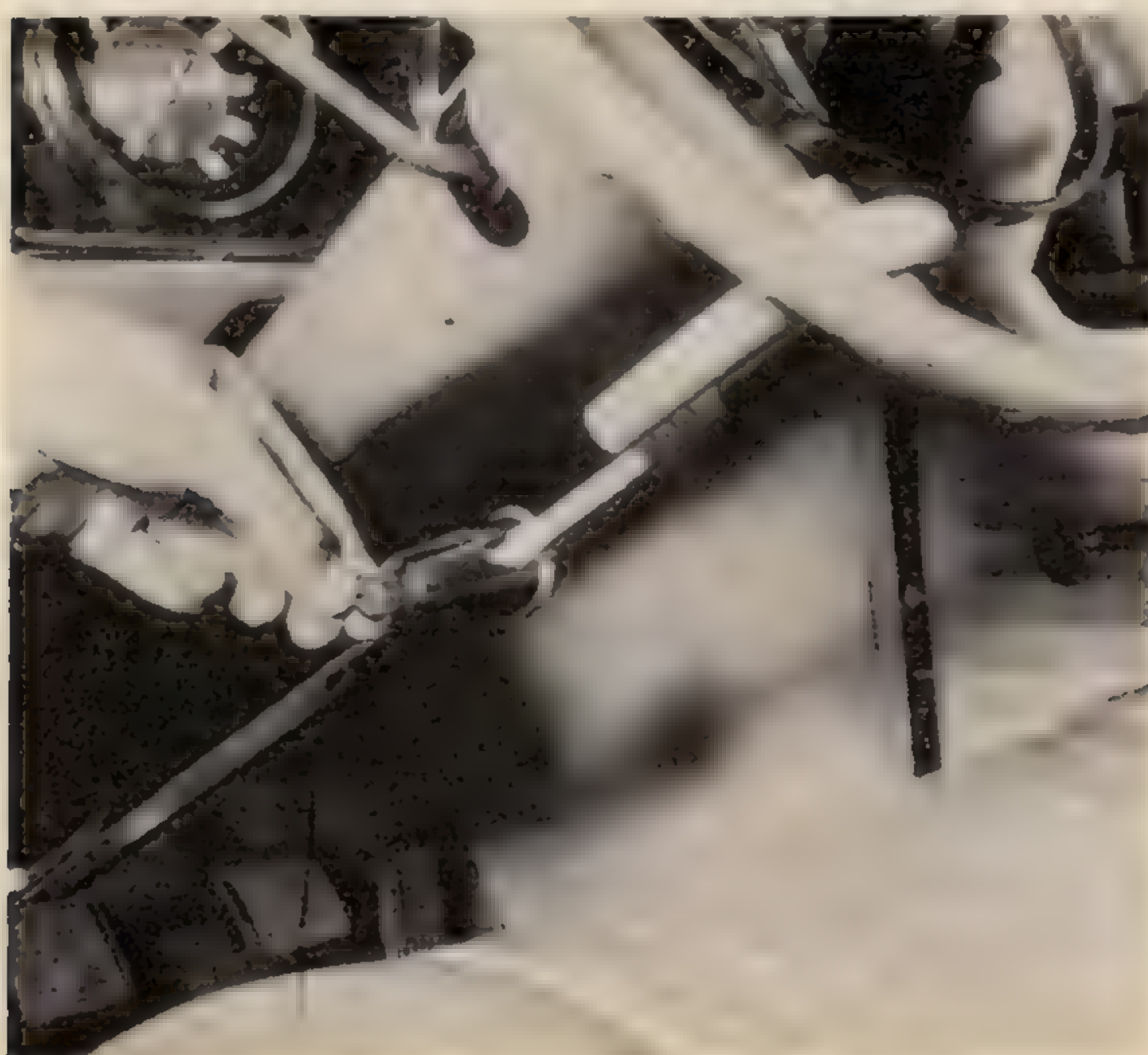
New Locks Help Discourage British Auto Thieves

Two new locks have been added to the British motorist's arsenal of defense against car thieves.

One, the Krooklok, is simply a bar of steel with hooks at either end. It fits over the steering wheel and around the clutch

pedal—and is locked so the car cannot be driven (lower left).

The Waso lock (lower right) locks the steering wheel and prevents the ignition from being turned on. It is permanently mounted on the steering column.





Bee Flat Sounds

Eavesdropping on bees with the Apidictor, an audio amplifier developed by a British sound engineer, enables a beekeeper to know the insects' mood. A low, bubbling sound means all's well; more noise means they may be ready to swarm.



Hat Full of Music

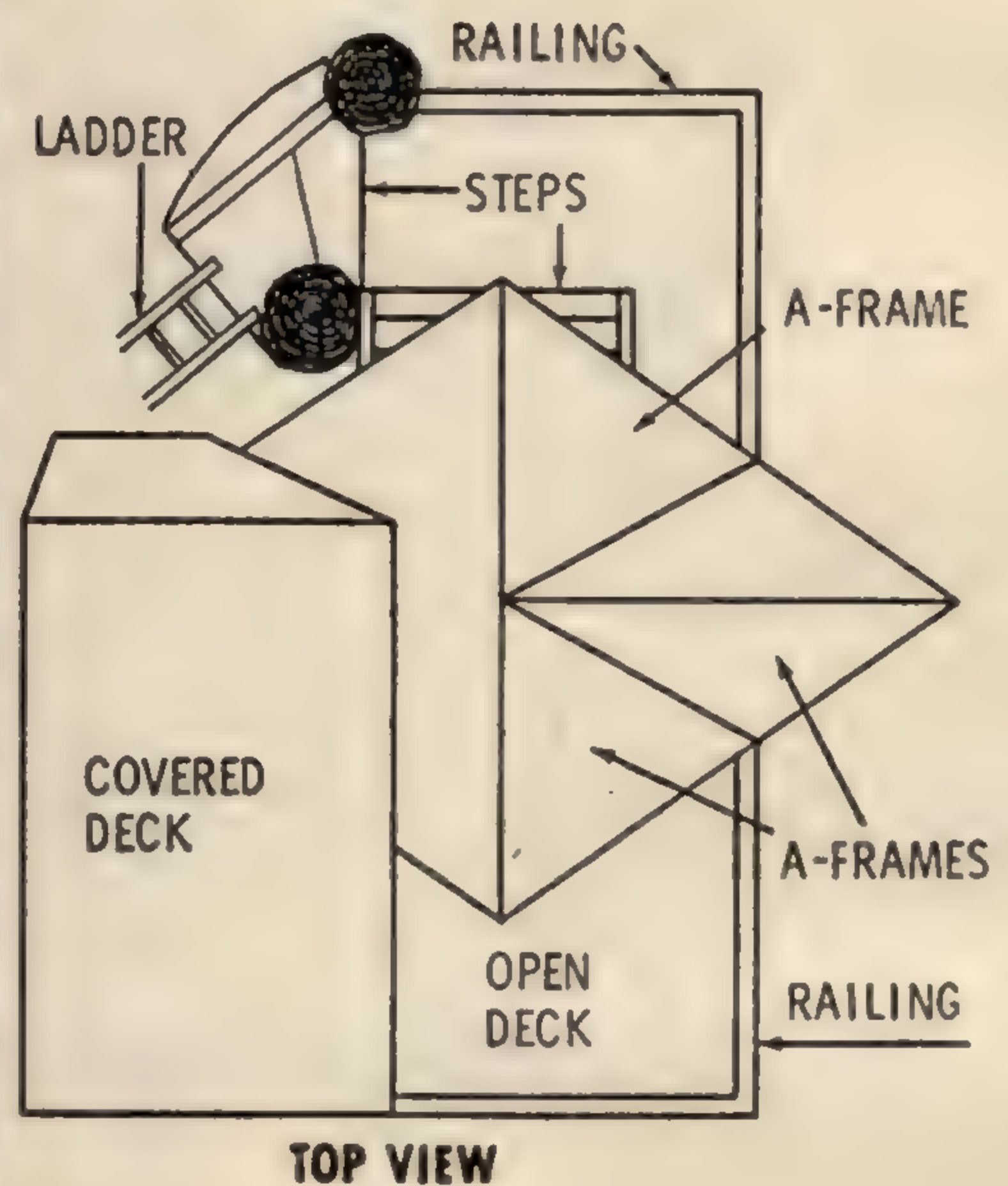
There's always music within earshot for the wearer of a new hat which has a built-in pocket containing a seven-transistor radio. An earpiece wire runs from hat to ear. Made by Hat Corp. of America, the TR Radio Hat sells for \$20.



Build a Modern Tree House

—With or Without a Tree

To get you off the ground, here are five different designs



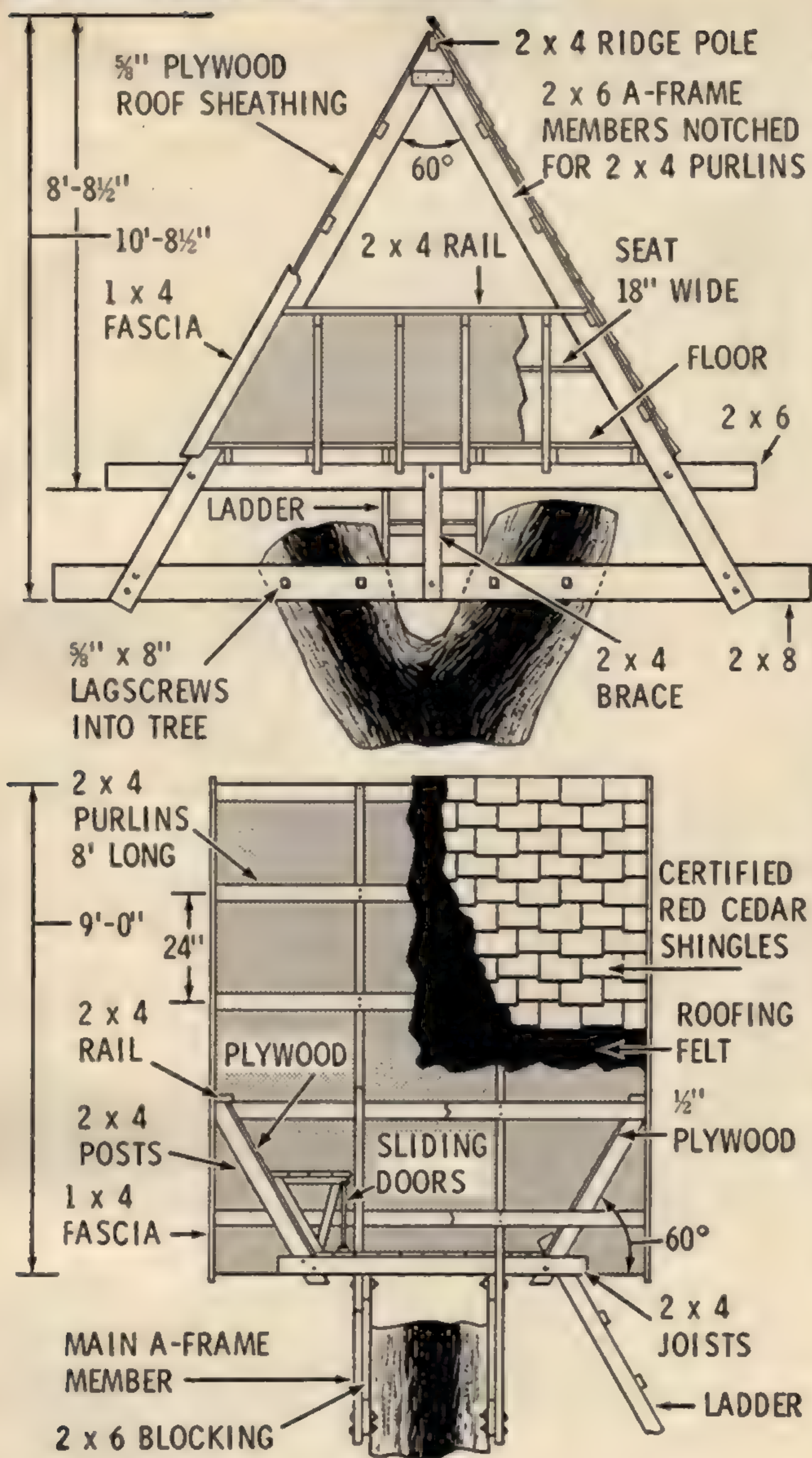
HOUSE OF MANY GABLES, left, designed by band leader Fred Waring for his 6-year-old son, has ridges from three A-frames set at right angles, as shown in roof plan above

LADDER CLIMBS to far end of lower deck—at right in this view from south. Front door is hinged panel of short unseen gable, up steps just right of center

LOWEST PLATFORM is "free form," jutting out between branches. Holes along edges have rope laced through and up to holes in floor joists, to form cage



SHOP AND CRAFTS



PERCHED ON STUMP of dead but solidly-rooted tree, this simpler A-frame needn't dodge branches. Built by Alfred Webber Jr., it sports red cedar shingles

HHEY DAD! Remember when you were a boy what great fun it was to climb up into a tree house? Well, even in this age of outer space, boys get just as big a kick out of "living it up" a few feet above the earth. It's the adventure of isolation—of lifting oneself into a special world where imagination doesn't have to keep its feet on the ground.

Of course, today's kids have too much sophistication to be content with that rustic platform, sagging above the crotch of a tree, that gave you a thrill. They want a perch that *looks* adventurous and inviting. And as far as that goes, you don't want to create an eyesore, either.

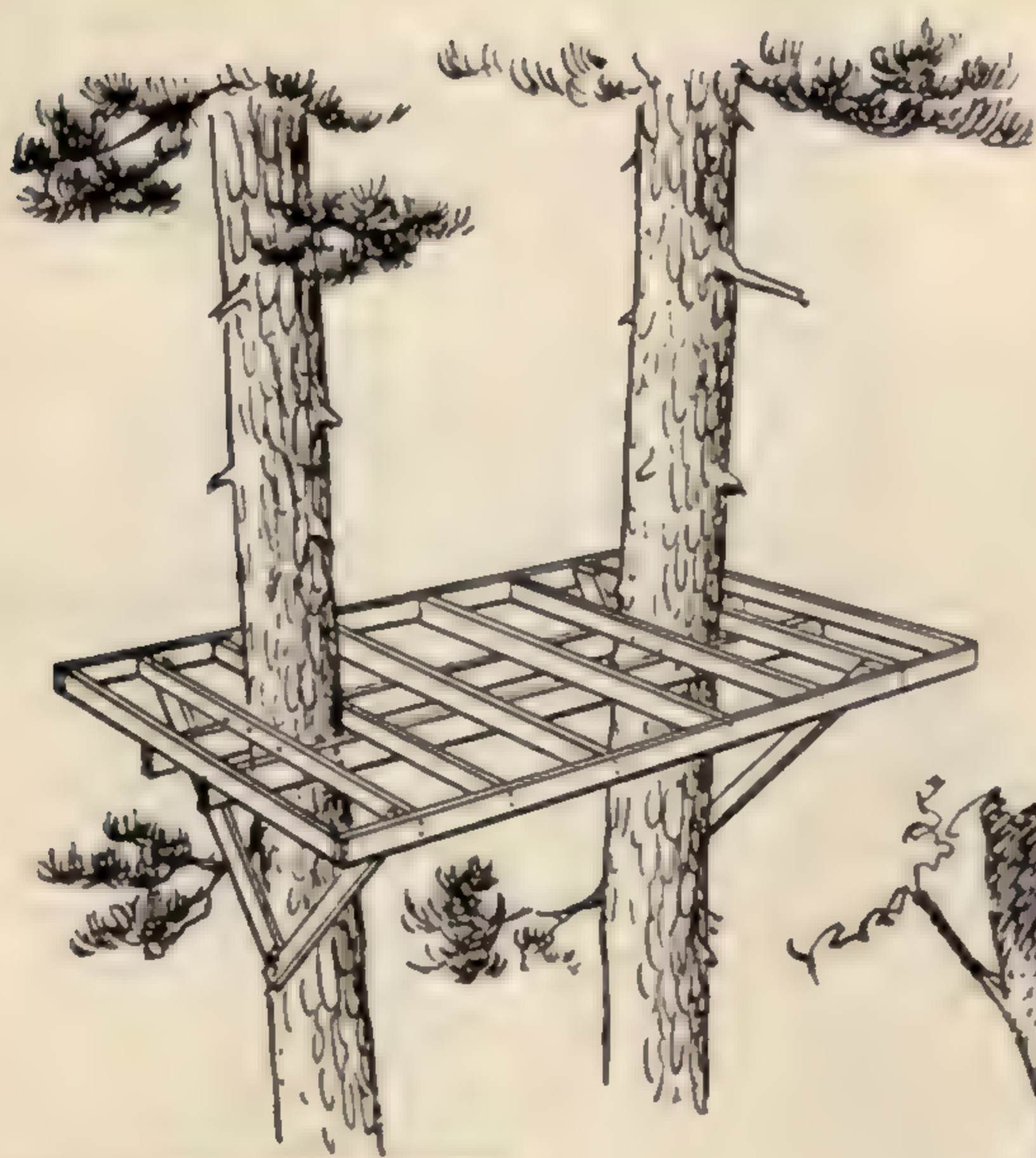
So here's a handful of novel designs you can build into any large tree in your yard—it needn't even be a live one. And if you don't *have* a tree, there's no reason to deprive your child of the fun you remember: you simply erect a house on poles.

In building either a tree or a pole house, it's a good idea to plan it out carefully on

paper—perhaps even build a scale model—before attempting to erect the structure. You may also want to check local ordinances to see if any sort of permit is required. Even communities that *have* such nuisance ordinances are often understandably embarrassed about enforcing them; but if you should build in violation of local codes, you'll be at the mercy of any complaining neighbors. So play it safe.

The design of any tree house is pretty much dictated by the size and shape of the tree it will perch in, so it's impractical to present exact plans, here. But we offer band leader Waring's house, on the facing page, for the many ideas it suggests. For example, the jutting roof-peaks that add space to a limited floor plan, and the plastic-rope "nest" at the first level. The A-frame design above, on the other hand, offers the novel idea of setting a house atop the fork of a dead tree. A hurricane left this trunk standing and, rather than pay the steep cost of having it uprooted,

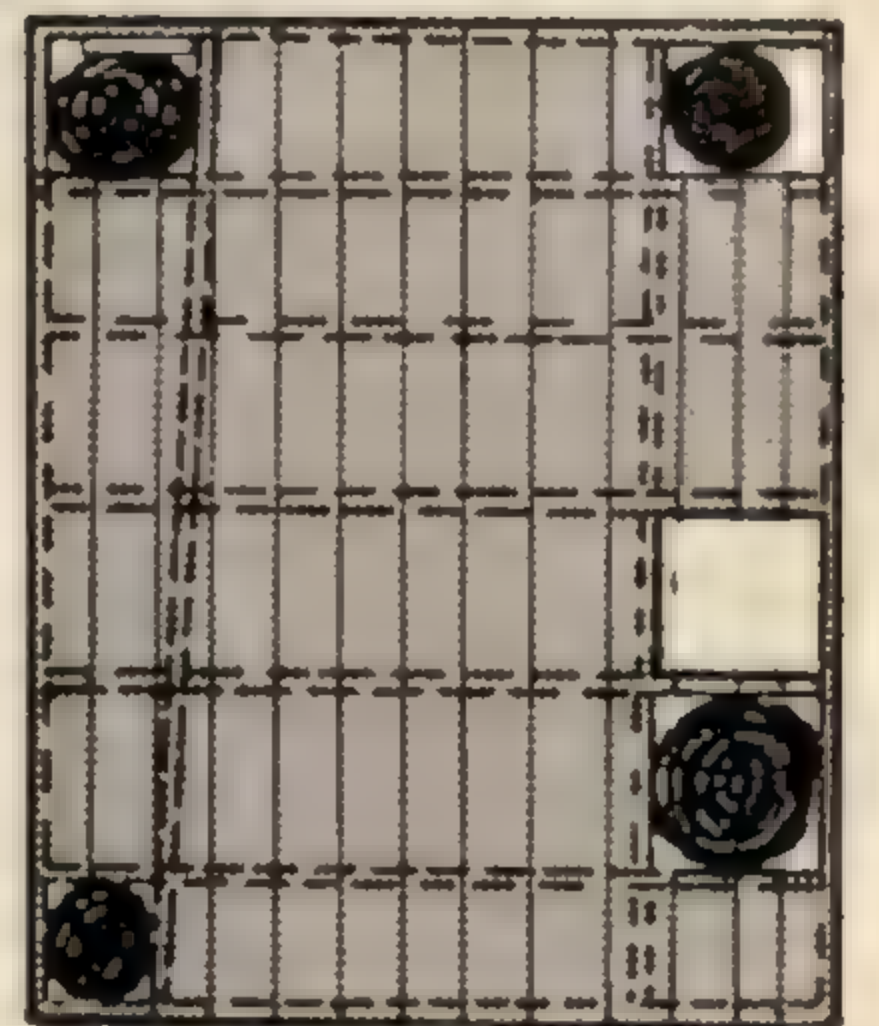
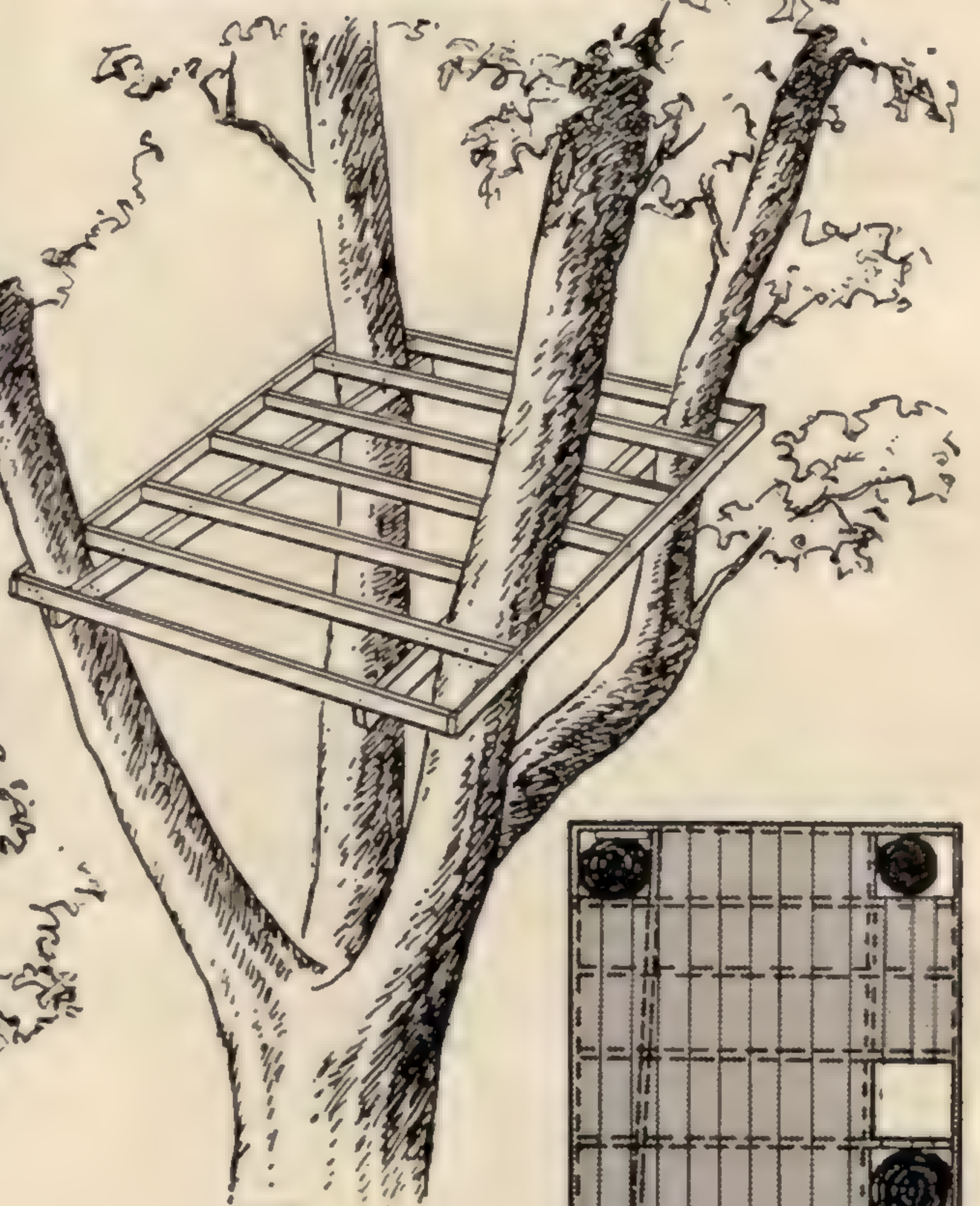
METHODS OF FRAMING TREE-HOUSE PLATFORMS



TRAP
DOOR

CUT,
FOLD,
TAPE

FREE
HOUSES



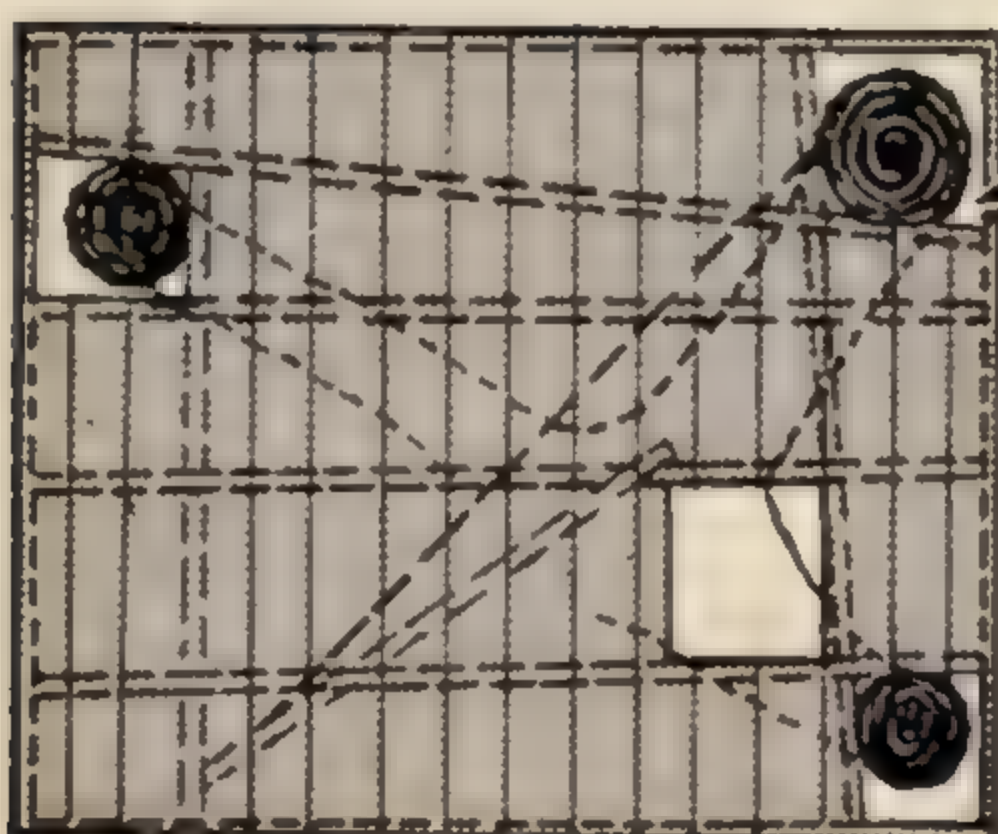
2 x 4 JOISTS
AND FRAMING

TRAP
DOOR
OPENING

2 x 6
BEAM

2 x 4
DIAGONAL
BRACE

WIRE ROPE
SUPPORT
FOR FREE END

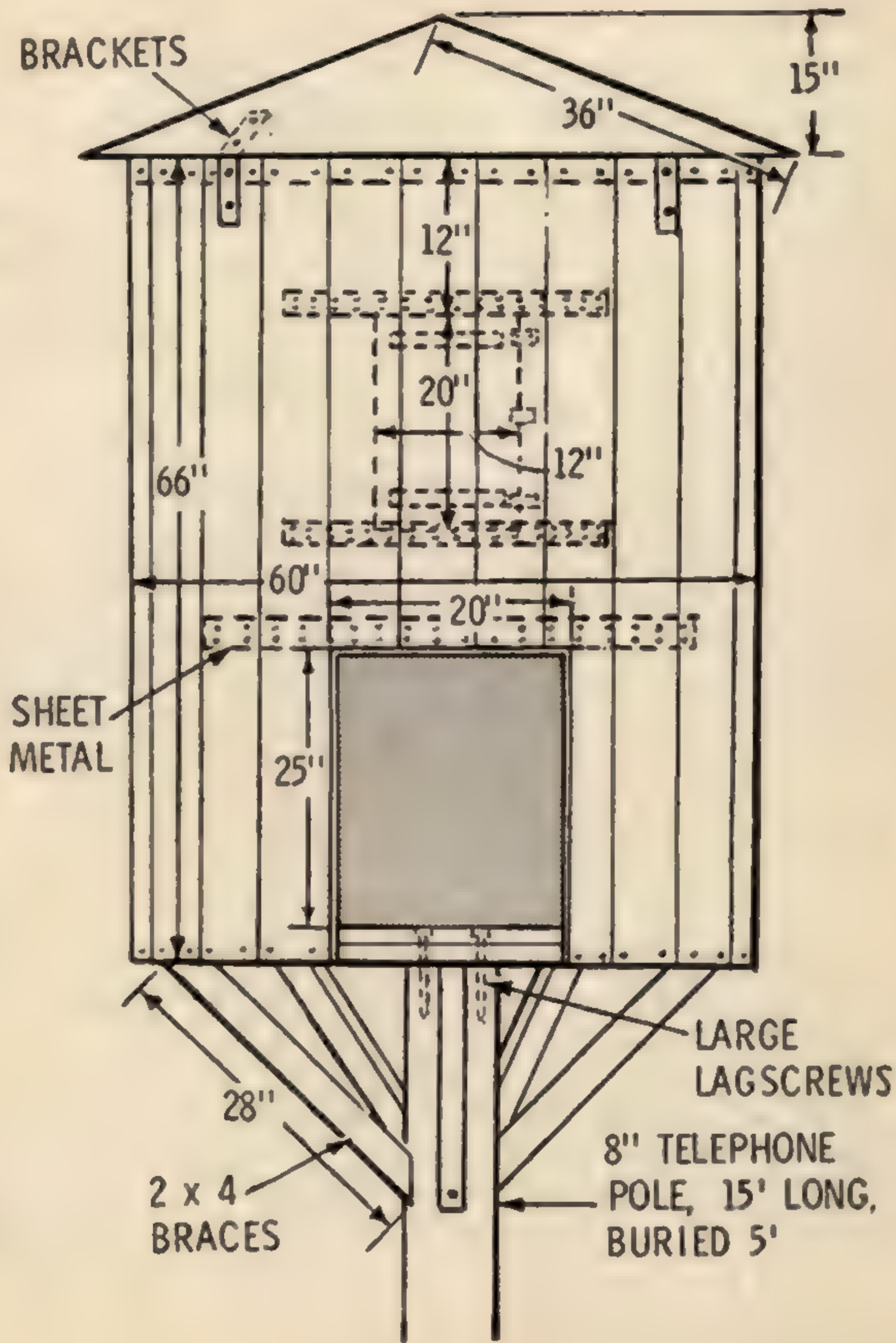
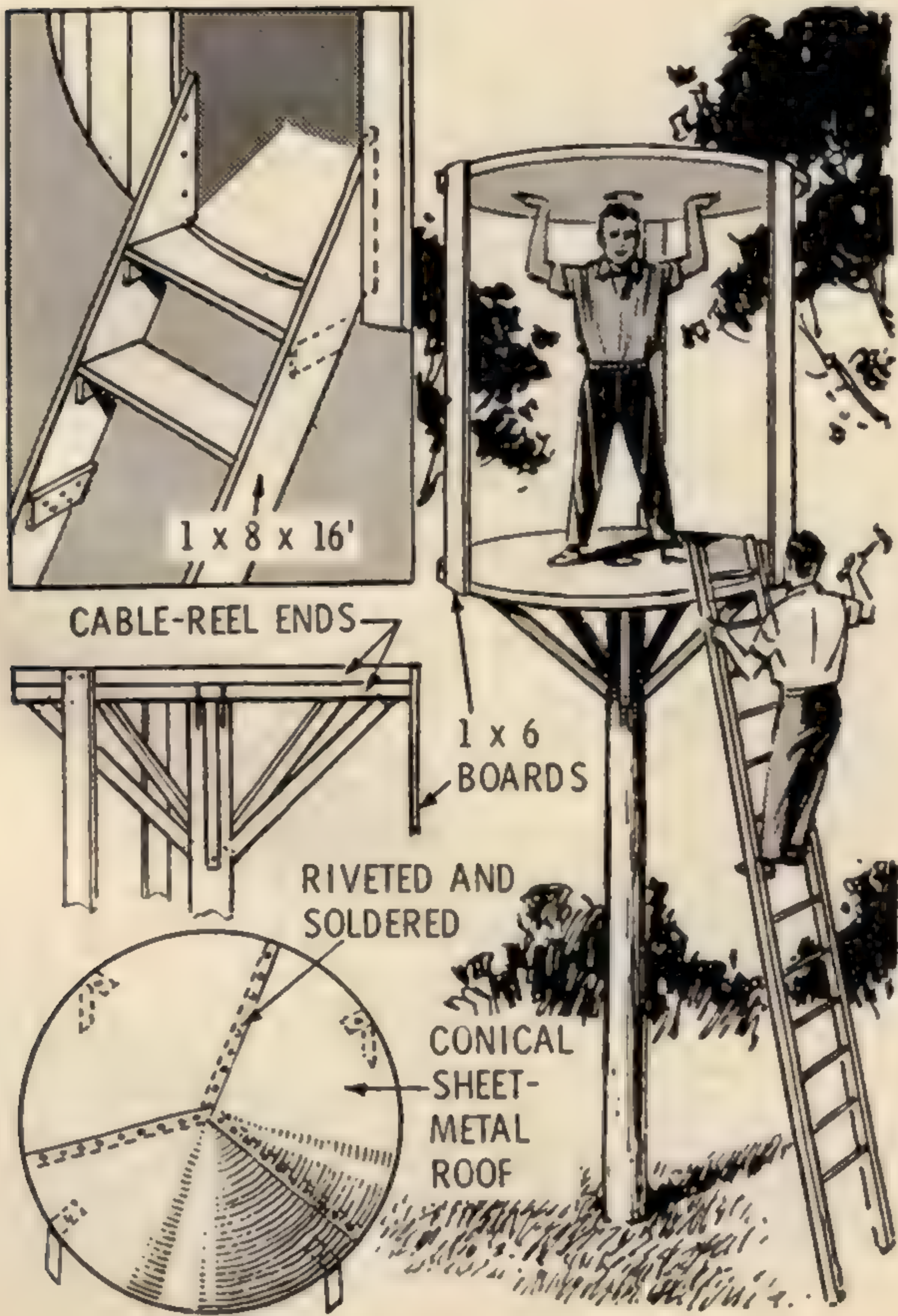


1½" TO 2"
CLEARANCE
AROUND
TRUNK

the owner salvaged it by perching a clubhouse on top. Again, to *copy* this house, you'd need a tree trunk of similar structure. But you could *adapt* the idea by constructing the A-frame on a platform supported by four poles (see page 130).

As originally built, the house is framed around two main "A" assemblies which extend down past floor level and bolt to cross beams that are solidly lagscrewed to the tree trunk. The 2x6 members of the frames are dapped on 24-in. centers to let in the 2x4 purlins and ridge pole that support the plywood roof panels. The 2x4 floor joists rest on two 2x6 cross beams which are also bolted to the main A-frames; flooring is applied to within 7½ in. of the ends of these joists. The canted railings across each end of the house are identical except that a doorway is cut in one to receive a hinged panel and the end of a ladder. A bench, with storage below, is built across the opposite end of the house and fitted with sliding doors. Red cedar shingles, laid in a staggered pattern, add to the attractive appearance.

Methods of framing sturdy platforms within various limb arrangements are shown at left. Bridging between two trees (first sketch) is not practical very far from the ground since the trunks will move independently in high wind, twisting the entire structure. The same goes for working too high above the crotch of the





branching trees seen in the other sketches.

Where no suitable tree is available, you can "create" one by planting one or more telephone poles, as for the "silo" house on the previous page, or the platform structure at the right. Telephone companies often have discard or surplus poles they'll sell you. They come in various lengths in two-foot steps, such as 14, 16, 18 and 20 ft., and are graded by the diameter of the top, such as 4, 5 or 6-in. tops.

Edward R. Robertson, of Advance, N.C., designed and built the "silo" house from a discard pole and an empty cable reel that cost him only \$2.00. He cut the pole down to a 15-ft. length and mounted one reel flange on it, bracing it underneath with 2x4s. Then he raised the pole and slid it into a 5-ft.-deep hole. After plumbing the pole, he tamped dirt around it.

Construction proceeds like this: you lean a ladder against the edge of the mounted flange and slide the other flange up it as you climb. When the loose flange is aligned on top of the first one, nail three boards, each cut 66 in. long, securely to the edge of the top flange, flush with the top face, projecting downward, and spaced equidistantly around the perimeter of the flanges. Mark the edge of the bottom flange on both sides of each board to determine where they are to be nailed when the top flange is raised.

You will need help to raise the top flange. Start raising it by hiking it up approximately 6 in. at each board, and driving a nail temporarily to hold it as you move around. Continue to raise the flange in this manner until one man can get his shoulders under it and raise it all the way. While he holds it, quickly secure the bottom of each board to the lower flange.



With this done, fill in all around with more boards, add the prefabricated, sheet-metal roof, and secure it in place with five angle brackets. Mount the feet of the ladder on bricks and fasten the top of it to the sides of the door opening to bring the top step level with the floor. For the sake of safety, Robertson placed the window high and the doorway low enough, so that not even a small child could tumble out.

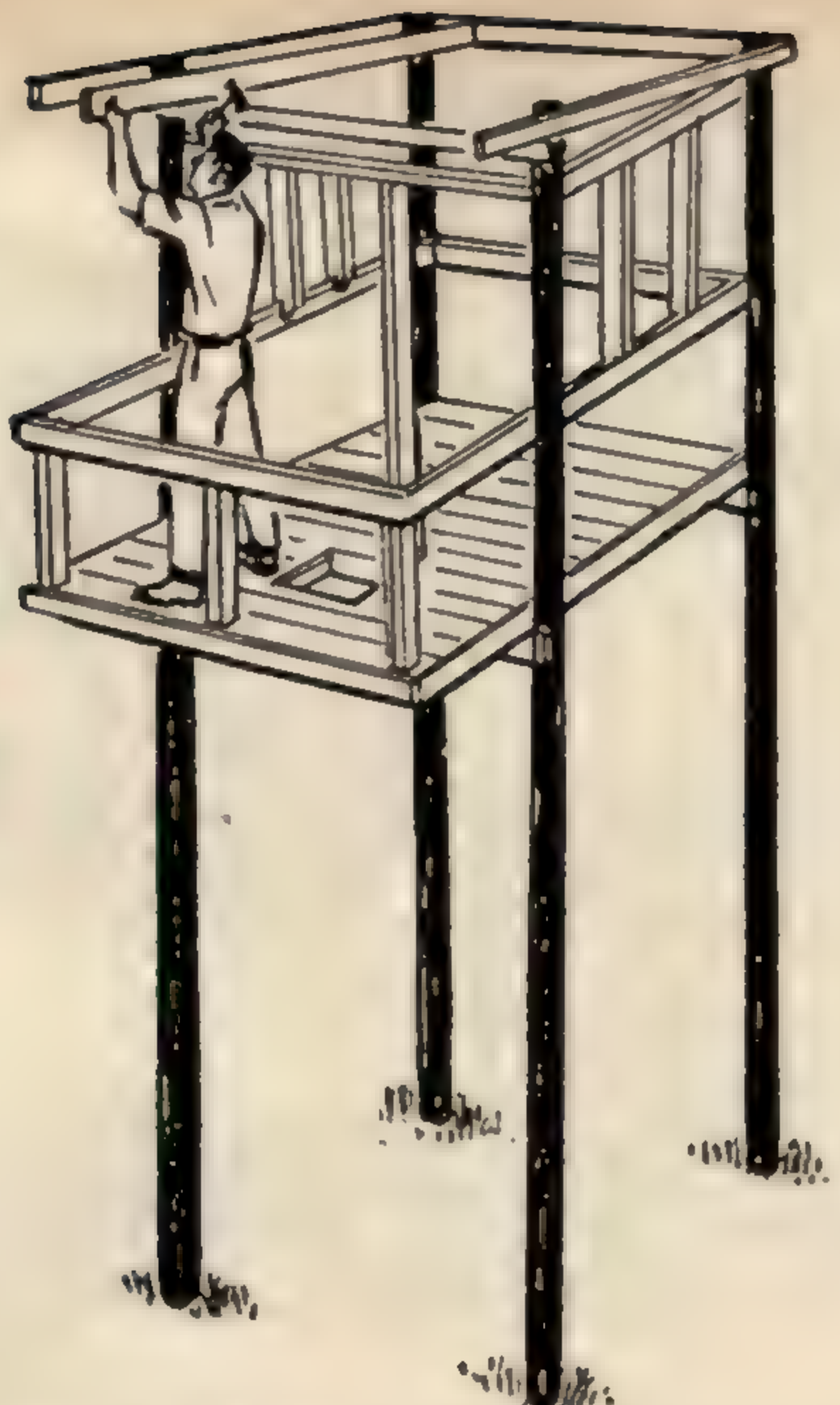
Poles for the "Four Poster" shown on these pages should be 5-in. top and 20-ft. long—lodge-pole pine, if available. Lay out the hole spacing and then, using a post-hole digger, dig holes deep enough so the poles will be buried about 5 ft.—or at least 6 in. below the frost line in your area. This will give your pole house a solid foundation, without fear of frost-heaving.

Drop the poles into the ground and back-fill just enough to hold them upright, but not so solidly that they will be hard to shift in their holes. Next level and bolt to the poles the 2 x 4 beams that support the floor at the desired height (about 15 ft. above ground), using 1/2 x 10-in. bolts.

Build the 2 x 4 floor frame on the ground and then, with the aid of a helper, hoist the frame in place and nail it securely to the poles and beams with 16d nails. Follow this by covering the floor frame with 1 x 8 boards and cut the hole for the trap door and ladder. Now you can back fill solidly around the base of each pole, soaking with a garden hose as you tamp the dirt. Be sure each pole is plumb.

Frame up the walls, railing and finally nail the roof rafters to the poles. Add the roof boards, close in the sidewalls and complete the job by adding roll roofing, starting at the low side and overlapping each strip 6 to 8 in. as you go. ★★★

3



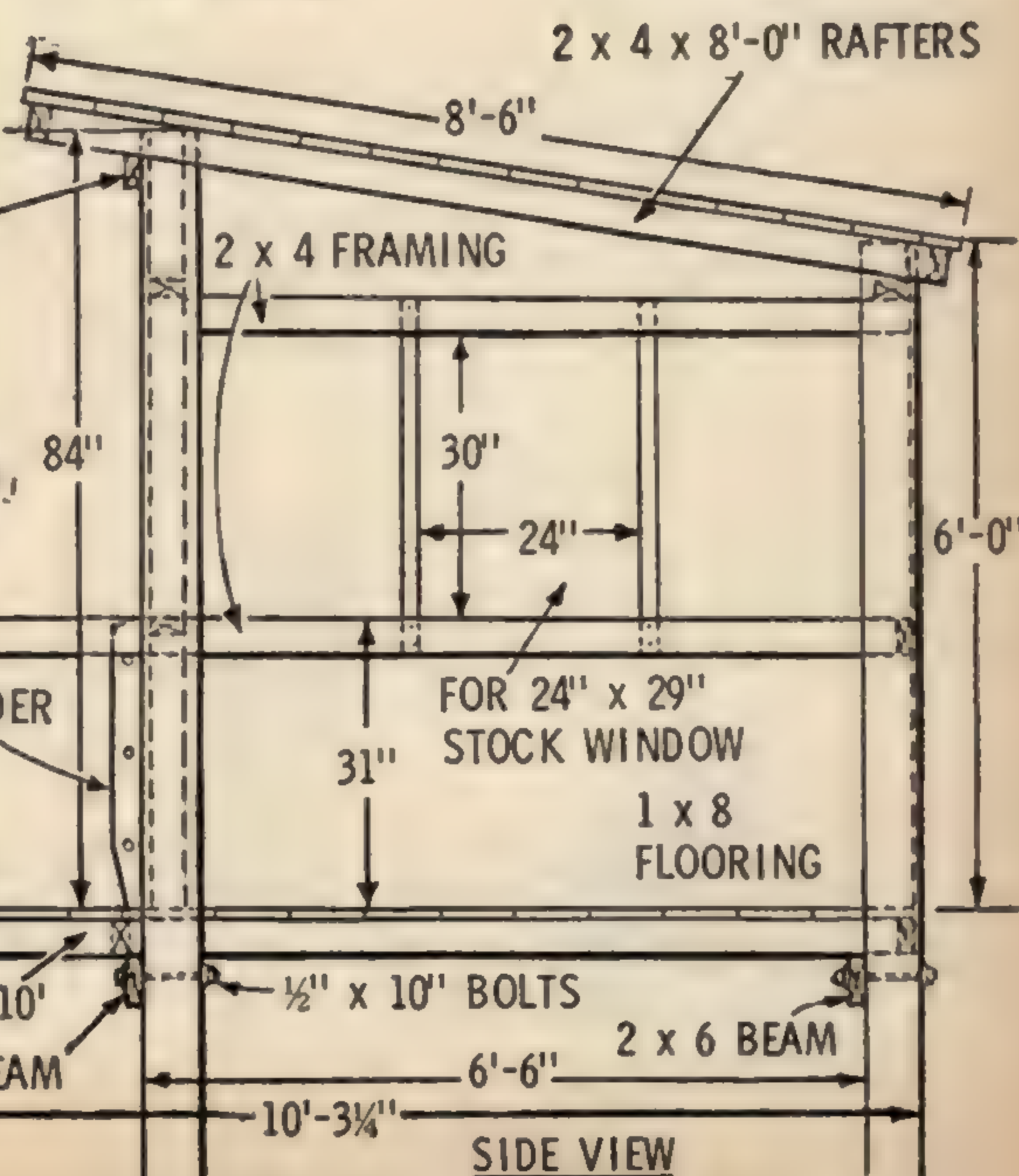
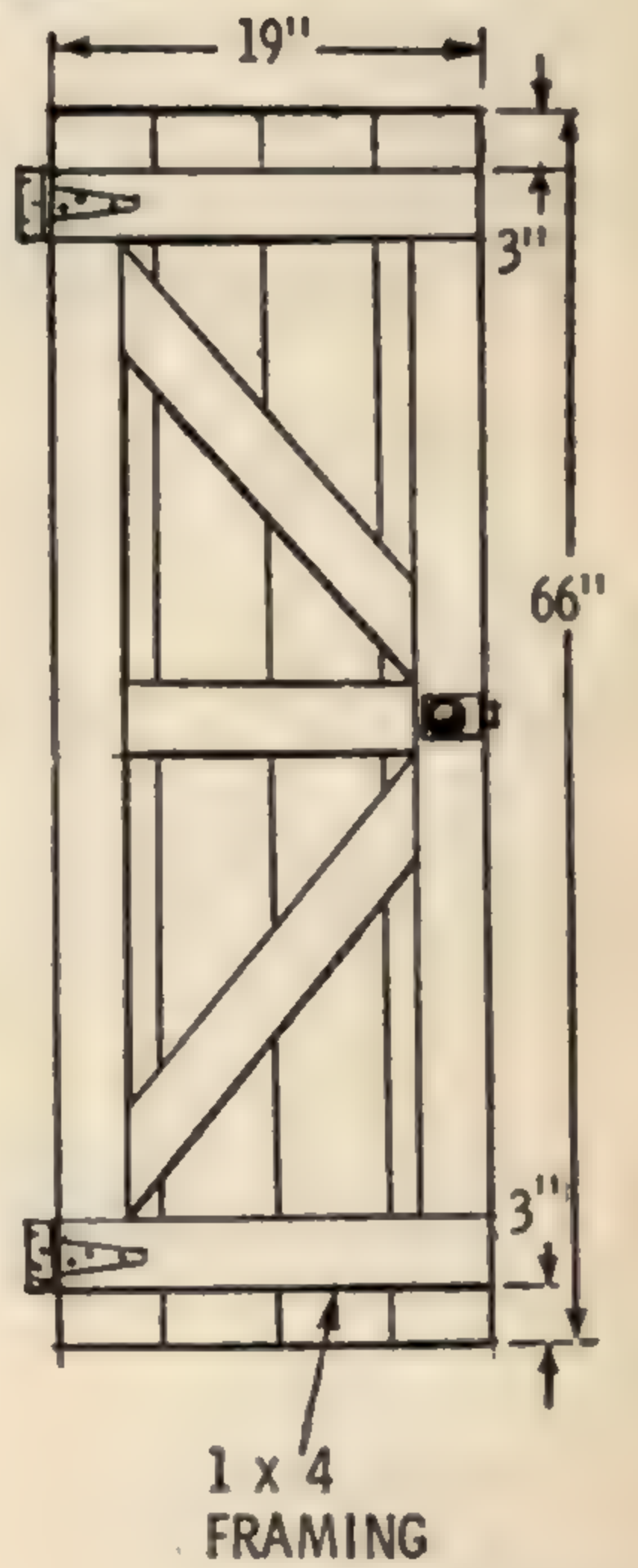
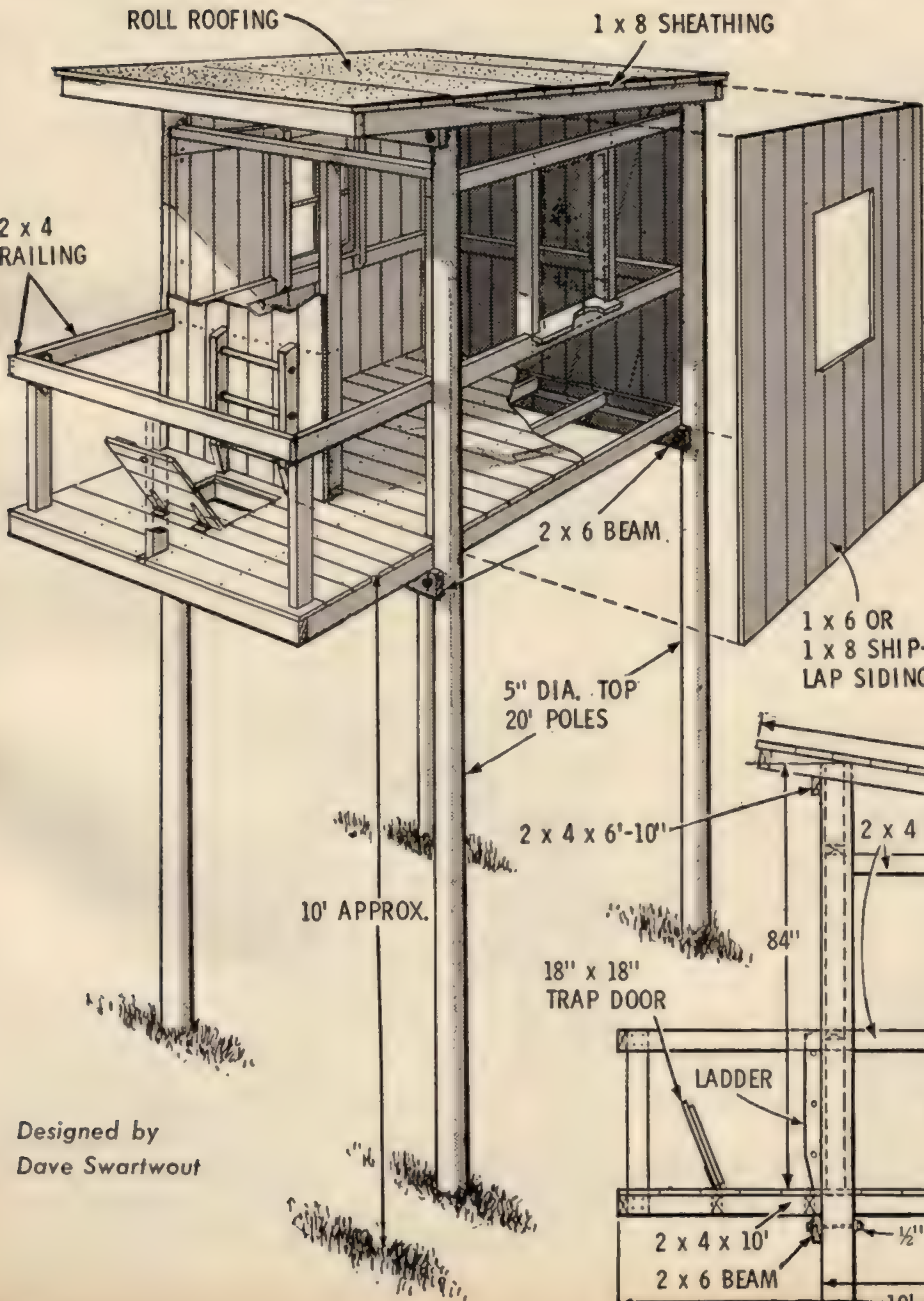
4



ROLL ROOFING

1 x 8 SHEATHING

2 x 4
RAILING



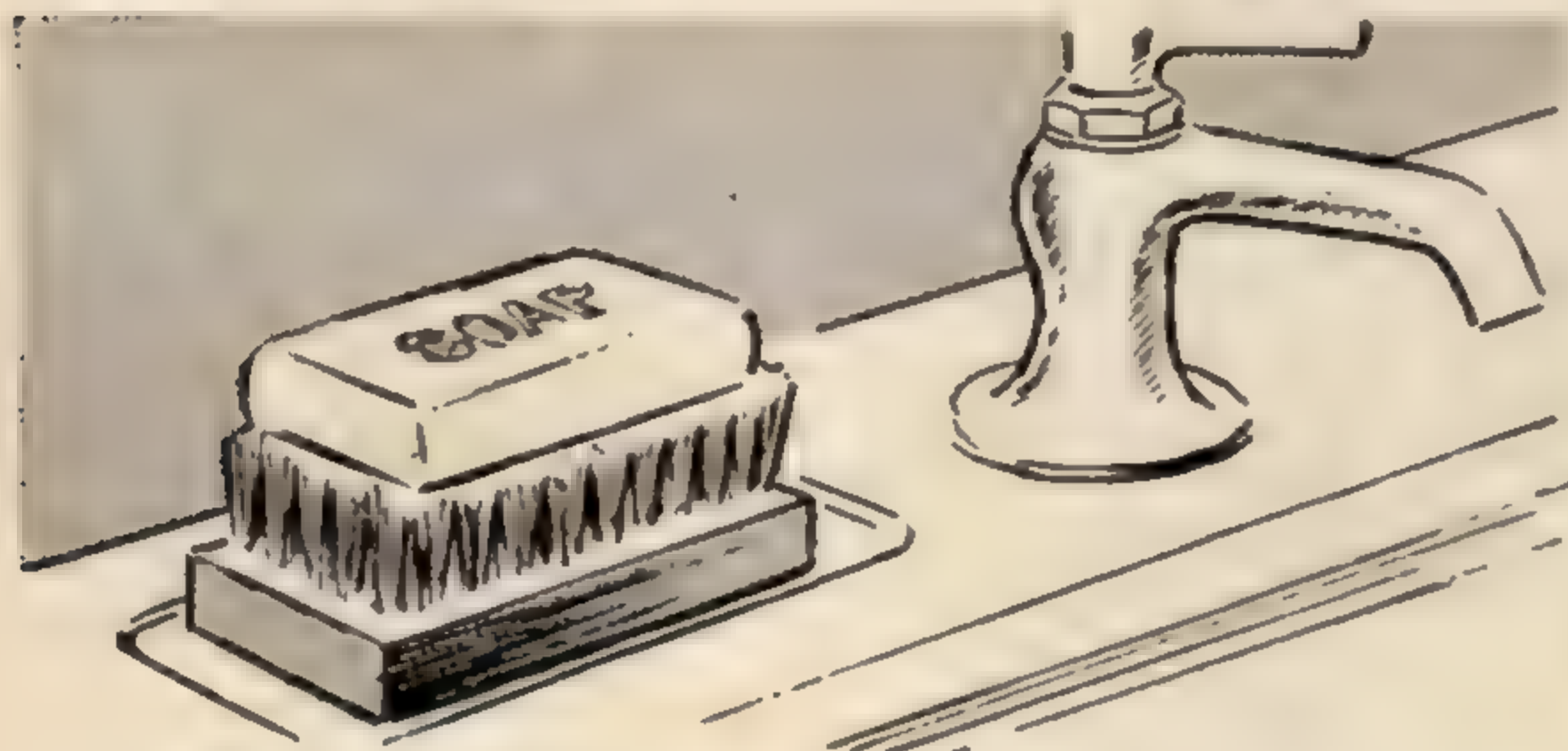
Designed by
Dave Swartwout



• Solving • Home • Problems

FROSTED VASE to ornament your wall can be made by cutting off the base of a large light bulb with a triangular file and inserting it in a wall bracket bent from wire or brazing rod and then polished

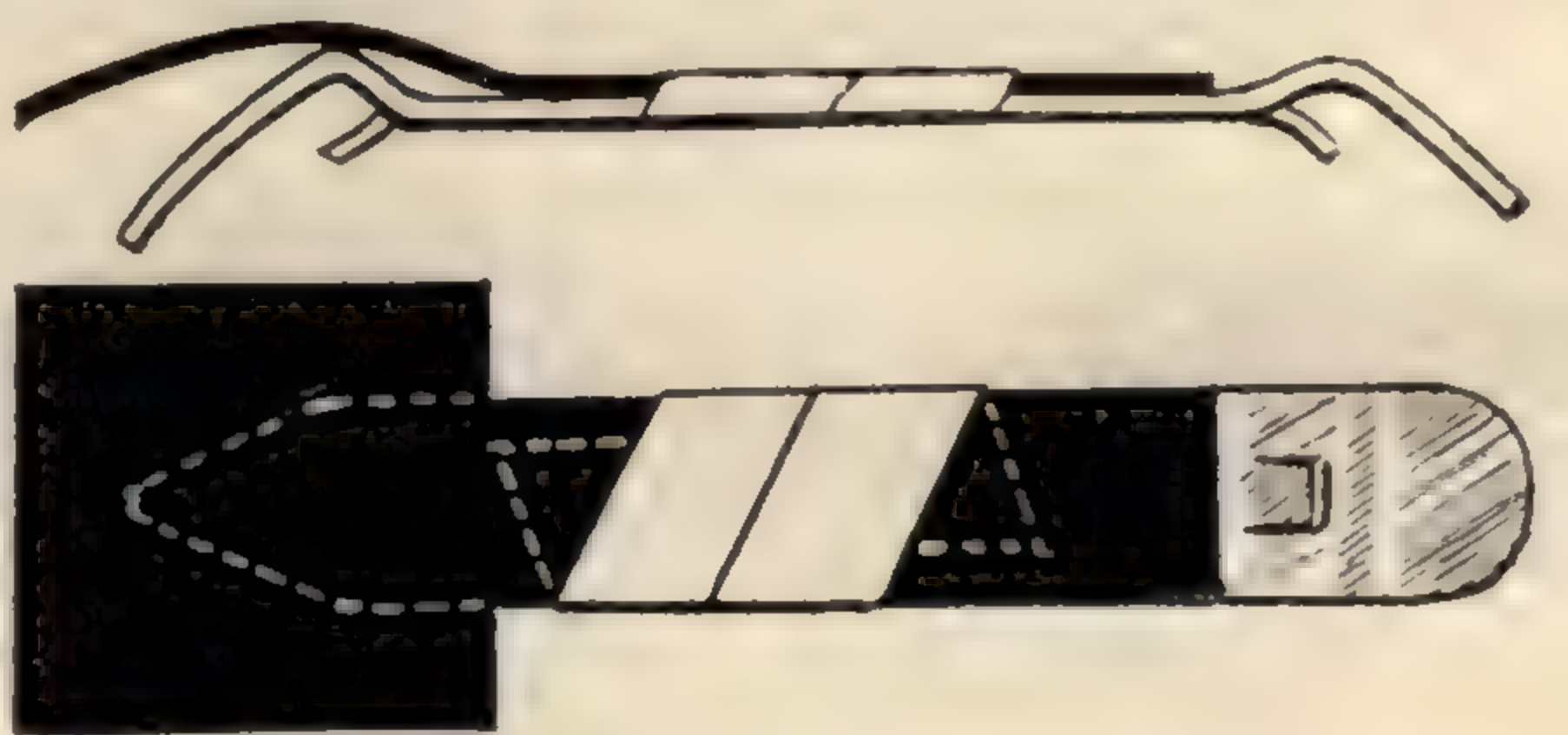
IF YOU LIKE pumice hand soap but would like to avoid that gray residue in the soap dish, keep a nail brush upside down on your shop sink and place the soap on the bristles. It's self-cleaning



CLEAN-UP TIME after painting will be greatly reduced if you keep a little turpentine handy in a push-type spray bottle near your workbench. It's great for removing paint or grease from your hands



BY ADDING A SHIELD to a beer can opener, you can keep beer, soda or other carbonated beverages from spraying freely when opened. Cut the shield from an inner tube or rubber glove and tape to opener

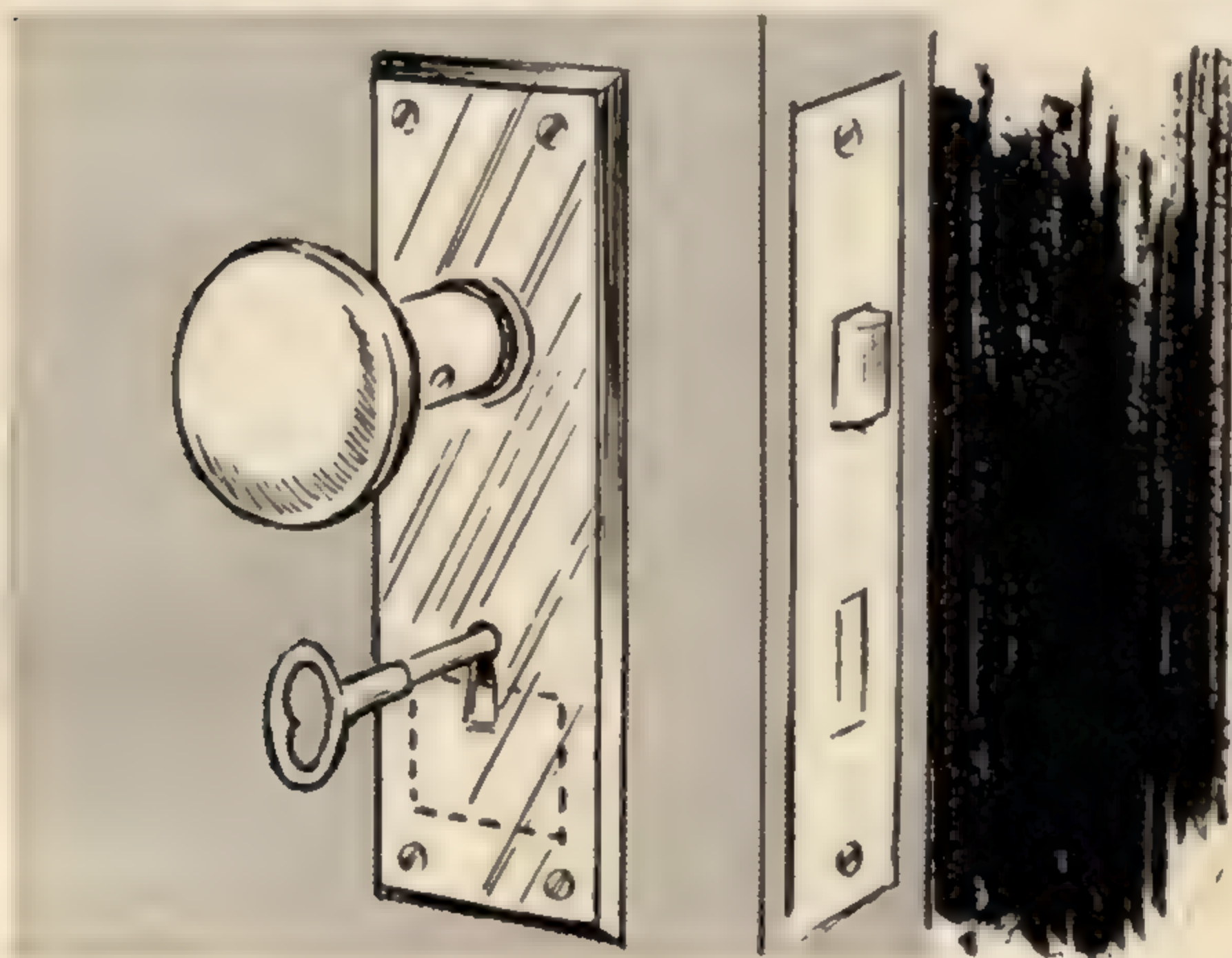


SAVE YOUR FINGERS when carrying hot liquids in a paper cup by making a cup holder from the plastic handle and band of a broken glass coffee maker. Cut the band to fit your favorite size paper cup





COMBINATION TOOL for removing rust and peeling paint can be made by cutting a slot in the handle of a wire brush to hold the blade of a putty knife, then drilling holes for bolts and bolting it in handle



TO PREVENT A BIT KEY from being removed or pushed from the lock from the outside, insert the key in the escutcheon plate and cover lower portion of keyhole with a metal plate mounted from the inside

TO CONVERT your old army foot locker into a fireplace wood box, strip it of its lock, top, hinges, and then refinish. Polish metal corners with wire brush, apply clear lacquer and add nylon casters on corners



TO STOP BANGING when two doors open against each other, mount a door stop near the top of one door. It's a simple solution to the problem of cushioning doors when stops can't be mounted elsewhere

ONE WAY OF REMOVING ink spots from the carpet is to pour table salt on the wet stain, sweep it up when it becomes wet and reapply as often as necessary. This works with old spots, if you moisten them



WITHIN THE EMBRACE of those privacy screens, and beneath the shelter of that jutting ridge-peak, your guests won't realize that this handsome patio is only a bonus adjunct to a garage



Building PM's Patio-Garage

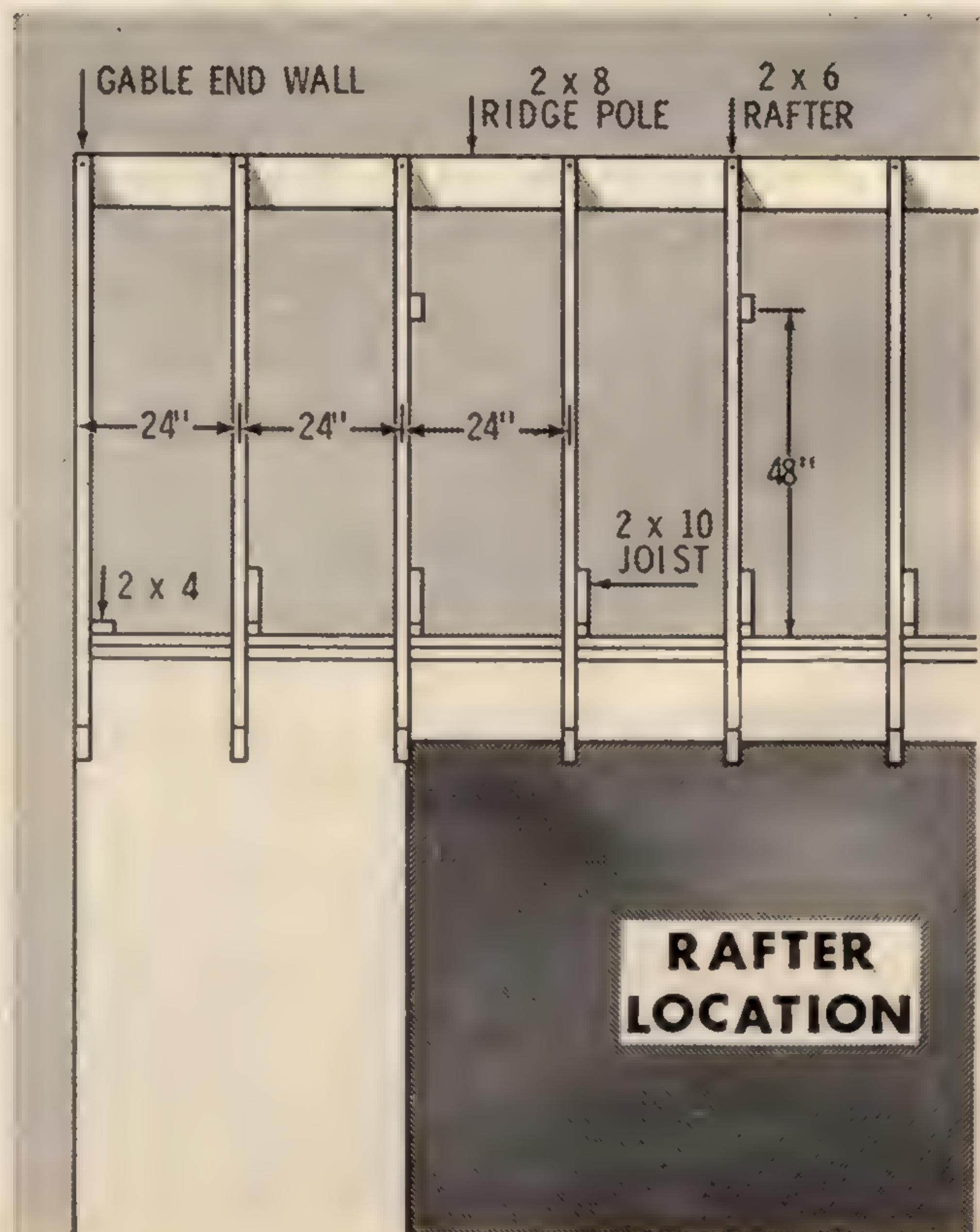
By Manly Banister, with Dick Chilson

PART III

LAST MONTH we got three walls up. Now, instead of tackling that more-tricky fourth wall (with its patio-kitchen alcove), we go directly to the roof.

You'll need enough 2x10s to space your joists 24 in. on centers; these boards should be delivered to you in exact 20-ft. lengths, so the only cutting they'll need is the bevel at each end to match the slope of the roof (see detail far right, center). That same sketch shows a 2x4 "nailer" set against the gable rafters, so that it caps the joint between the doubled top plates of the meeting walls. I installed this in place of a more-expensive joist, to provide backing for a future ceiling. But if you're likely to install a floor, instead, you'll need a joist here.

Information on cutting rafters for a $\frac{5}{12}$ pitch was included in last month's installment. Since they're identical, you only need lay out one, to use as a pattern. Every other pair of rafters is braced with a 2x4 collar tie. (Some builders tie only every *third* pair.) The five photos at the top of the next three pages show how the 2x8 ridge board (or "pole," as my con-



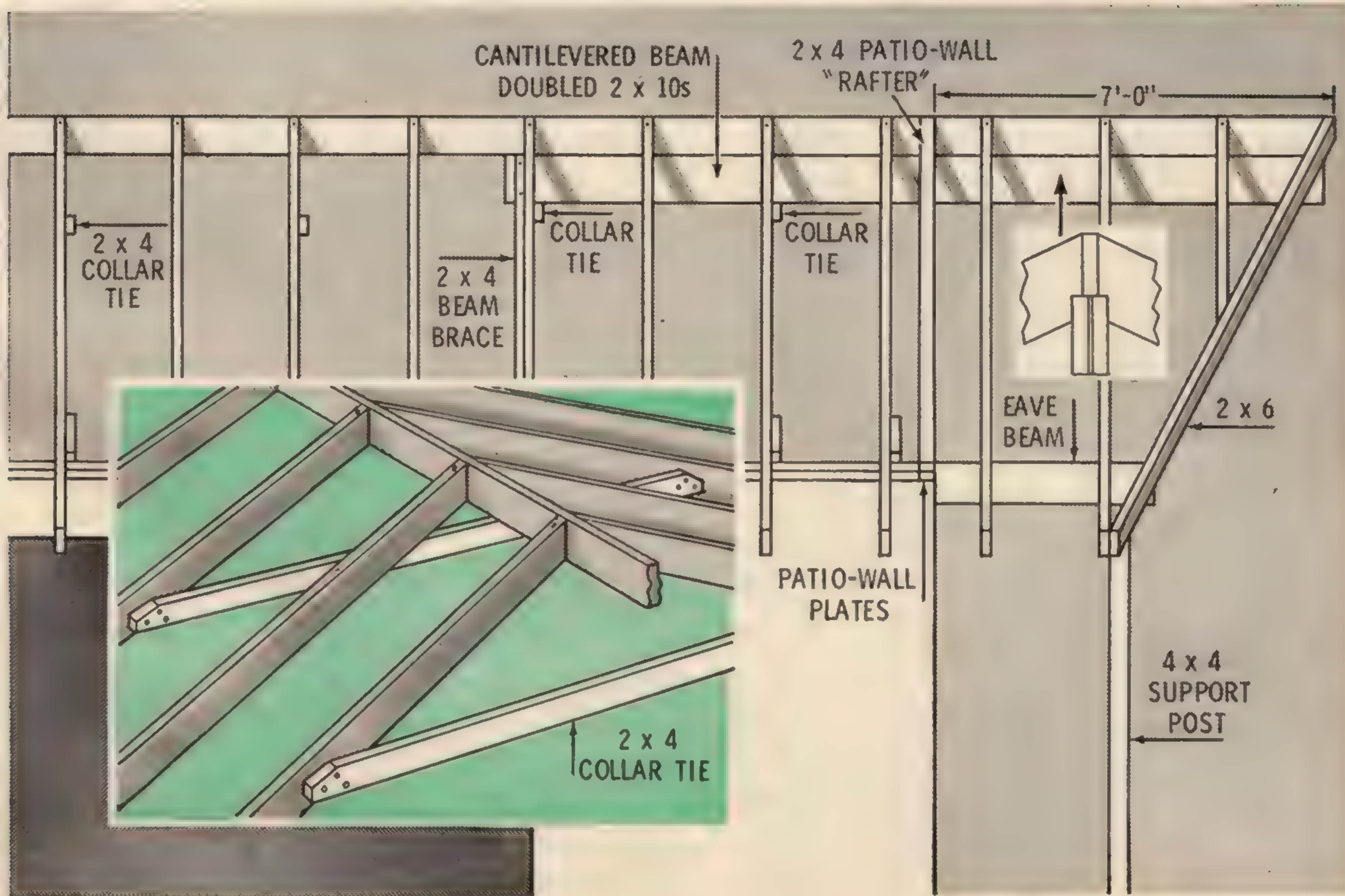
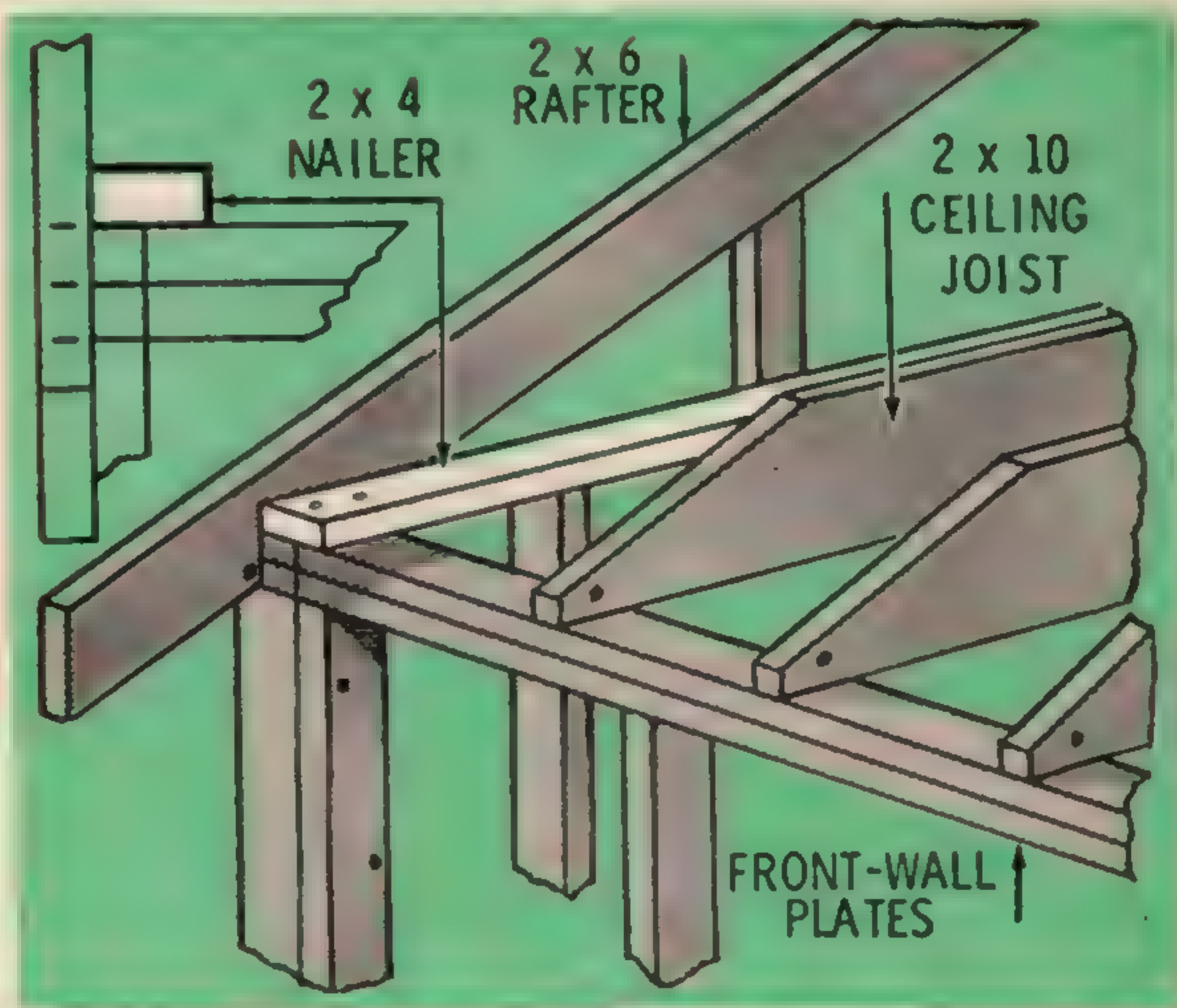


POSITIONING JOISTS is two-man job. They rest on—and are nailed to—top plates of eave walls and are spaced 24 in. o.c. End bevels match roof pitch



RIDGE POLE is installed in sections as rafters go up. Man at right is leveling ridge by means of marked upright—ridge pole will be nailed to it temporarily

tractor friend and co-author terms it) is extended, in several sections, as more rafters are installed. At the patio end, the ridge treatment alters because of the 7-ft. cantilevered thrust of the roof peak beyond the end wall. As shown in the side view below and the front-view detail on page 137, this beam is supported beneath the ridge pole on two 2x4 collar ties, and by the 2x4 braces that are anchored to a joist at rafter No. 11. I was able to secure a fourteen-foot 4x10 for this beam, but if you're not so lucky, you can "lamine" one by spiking two 2x10s together, as you did for door and window headers—except that here the $\frac{3}{8}$ -in. spacer between the 2x10's should be in one 4-ft. piece, so that





MORE RAFTERS are added, left—nailed to joists and to ridge pole (note temporary support at end)

CANTILEVER BEAM is held in place by collar ties and beam brace, topped with ridge pole extension

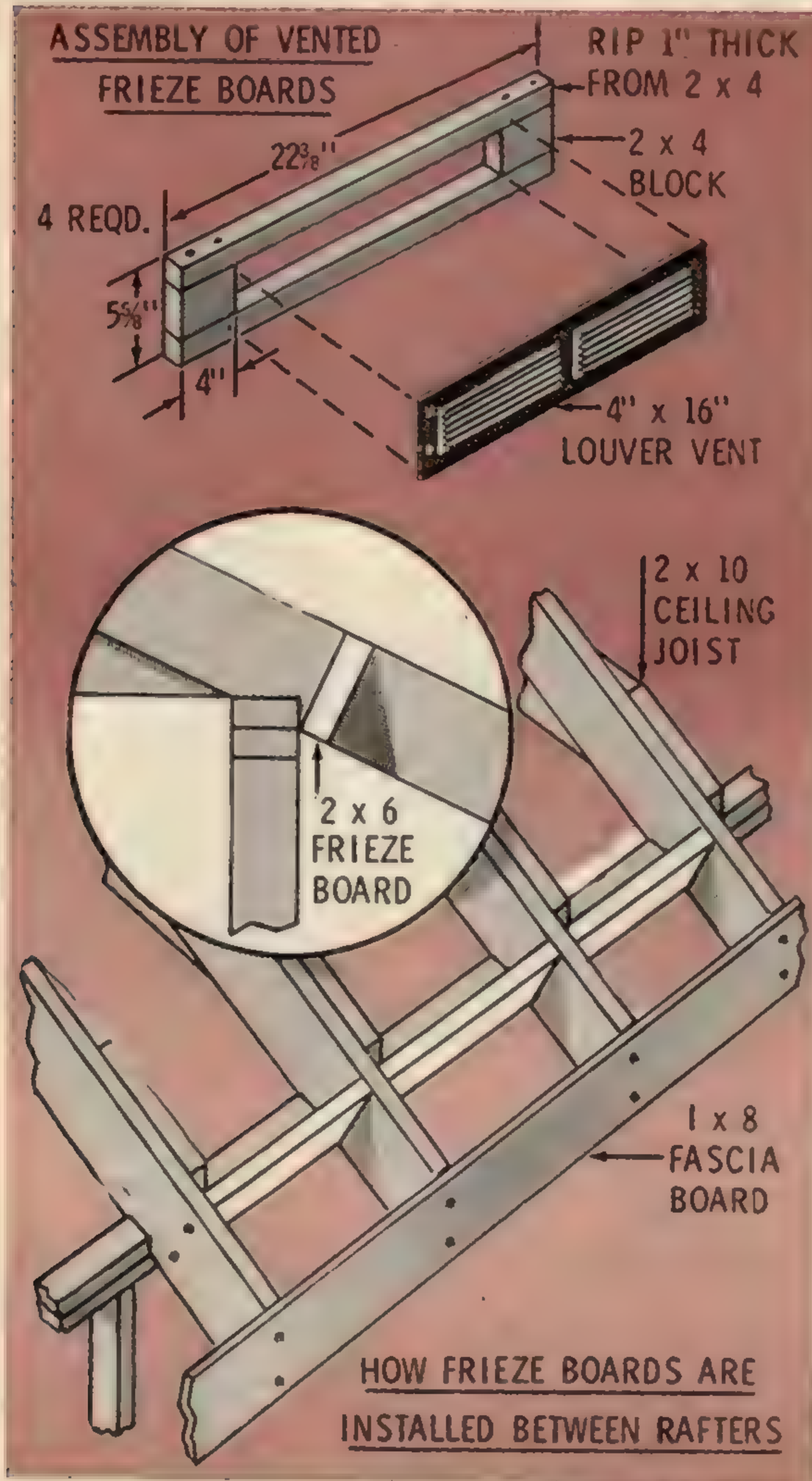
no gap will show along the bottom of the exposed beam.

The ridge pole is run out on top of this cantilevered beam—both to provide a nailer for the rafters and to eliminate the under-peak roosting of small birds. It stops short of the beam's end, however, just enough to create a rabbet to take the thickness of the angled facing "rafters."

Once all 16 pairs of full rafters are in place, nail a fascia across their vertical ends. Take care to drive the nails at an upward angle so they'll follow the grain of the rafters and not "point out" under the eaves. The sketch at left also shows how we nailed 2x6 frieze boards *between* the rafters; unlike the fascia, these were set square with the rafters, so are at an angle to the wall. These are set snug against the doubled top plates of both eave walls, sealing out the weather. But because I intend to insulate my garage for winter use as a workshop, I spotted louvered vents in several of the frieze boards—plus foot-square vents in both gables—to pro-

PORTABLE POWER SAW, like 8-incher, lower left, zips through siding stacked three deep and several wide

FRIEZE BOARDS are toenailed between rafters as shown in sketch left, photo below. Four are vented



vide air circulation above my insulated ceiling. This is a good idea, too, if you plan to install a floor for attic-type storage. This treatment of the overhang, incidentally, is not the one suggested on the architect's blueprints presented on pages 140-141 of the April issue. There, the rafter ends are left square (which sets the fascia board at an angle to the wall) and the overhang is boxed in by means of a plywood soffit. But unless exposed rafters are objectionable, you'll find our method practical—and less expensive.

The sketch below right shows how to finish the outside of the gable wall with 2x4 roof-line trim and a horizontal batten. Note in the sketch below right that a filler piece must be inserted between the rafter and the 2x4 trim at the overhang, to make up for the thickness of the board siding that's sandwiched between.

You're now ready to apply your roof boards, as shown on the next page. Just cut the Douglas fir shiplap to size with a portable circle saw, and nail it down, seeing that all end joints fall over a rafter—yet are staggered so that no more than two joints line up in a row.

Work from eave to ridge—and toward the patio overhang, letting the boards project beyond the angled edge. You can trim these flush when the roofing's done by snapping a chalk line and running your circular saw along it.

With the shiplap in place, go inside the garage and nail a 2x4 cleat all the way across the underside of the roof (called patio-wall rafter, page 135) to provide a nailer for the patio wall framing. Though we won't be detailing the construction of this wall until next issue, you must install this cleat before shingling so that you can drive nails through the shiplap and clinch them from above. You locate the cleat by means of those short tie plates we nailed



NAIL ON 2x6 facing with angle-cuts at top end butting each other, not ridge pole. A 2x4 prop under end of beam supports man's weight during roofing operation. Two short jack rafters will be nailed in next

into the gaps left in the "dap" of the eave-beam extensions (described last issue).

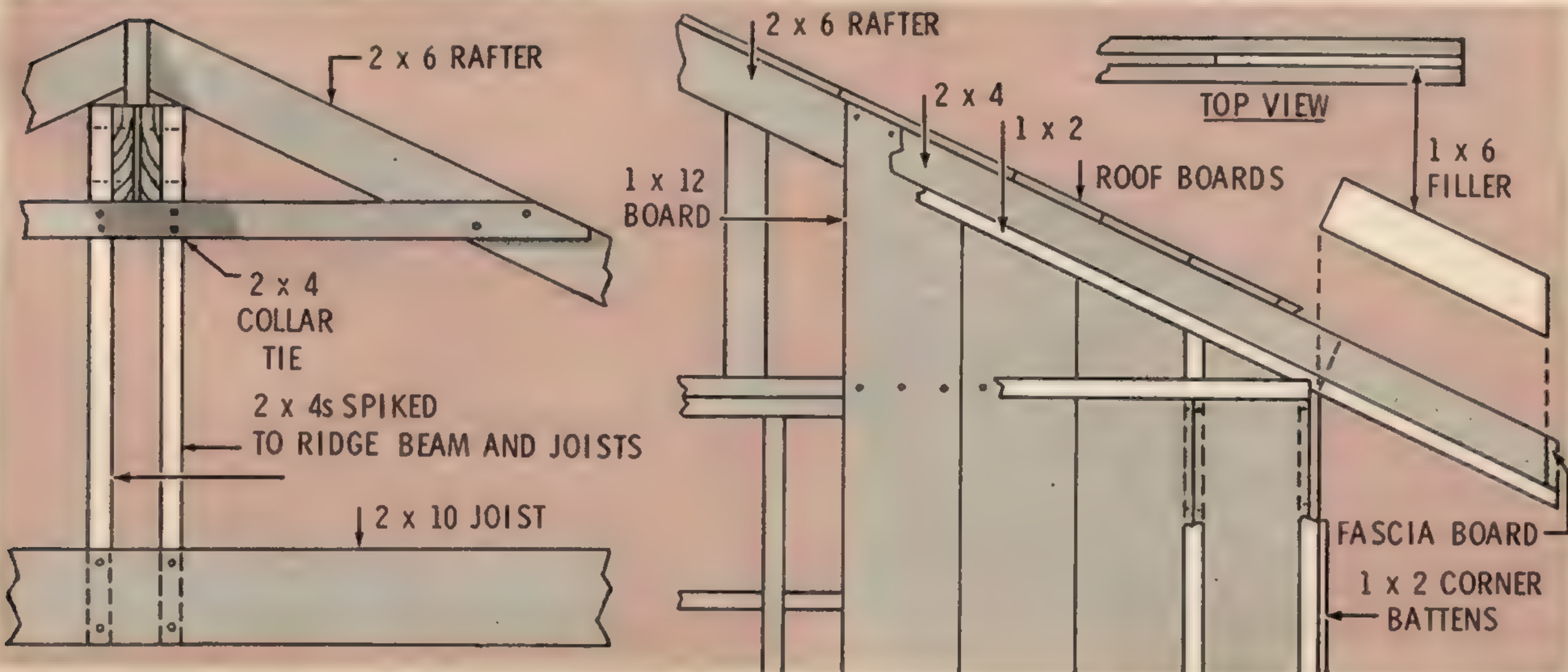
Now, cover the roof with 15-lb. building felt. You'll need three rolls. But before applying any asphalt shingles, you should add the sheetmetal "gutter" (detailed next page) along the edges of the swept-back overhang, to keep roof water from dripping off the angled edge. Bend a 4-in.-wide strip into a lopsided T to fit over the edge of the roof boards and the facing rafter.

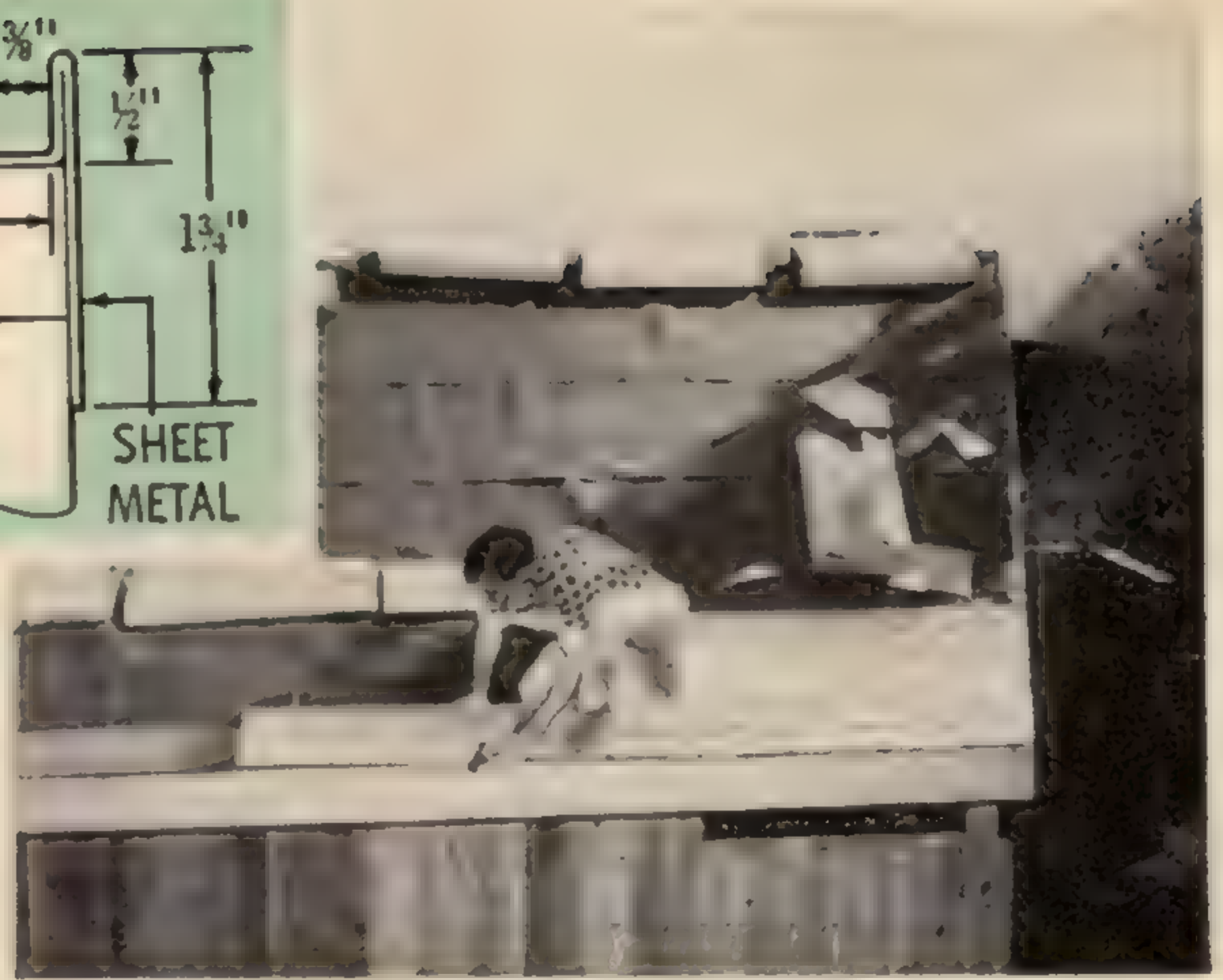
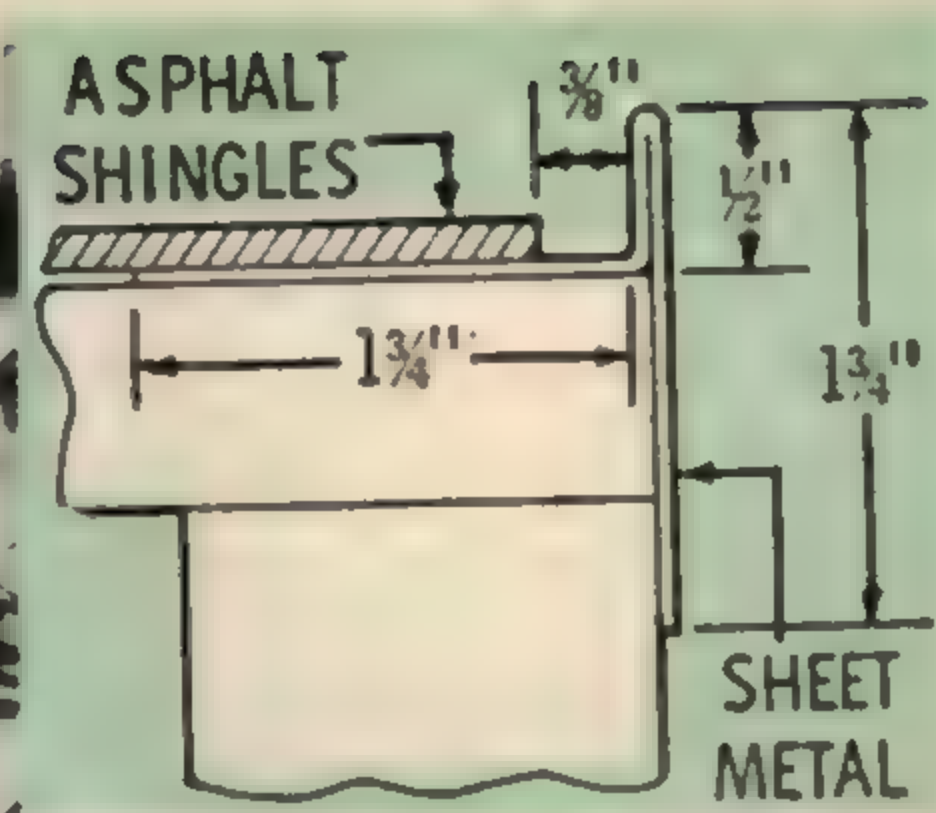
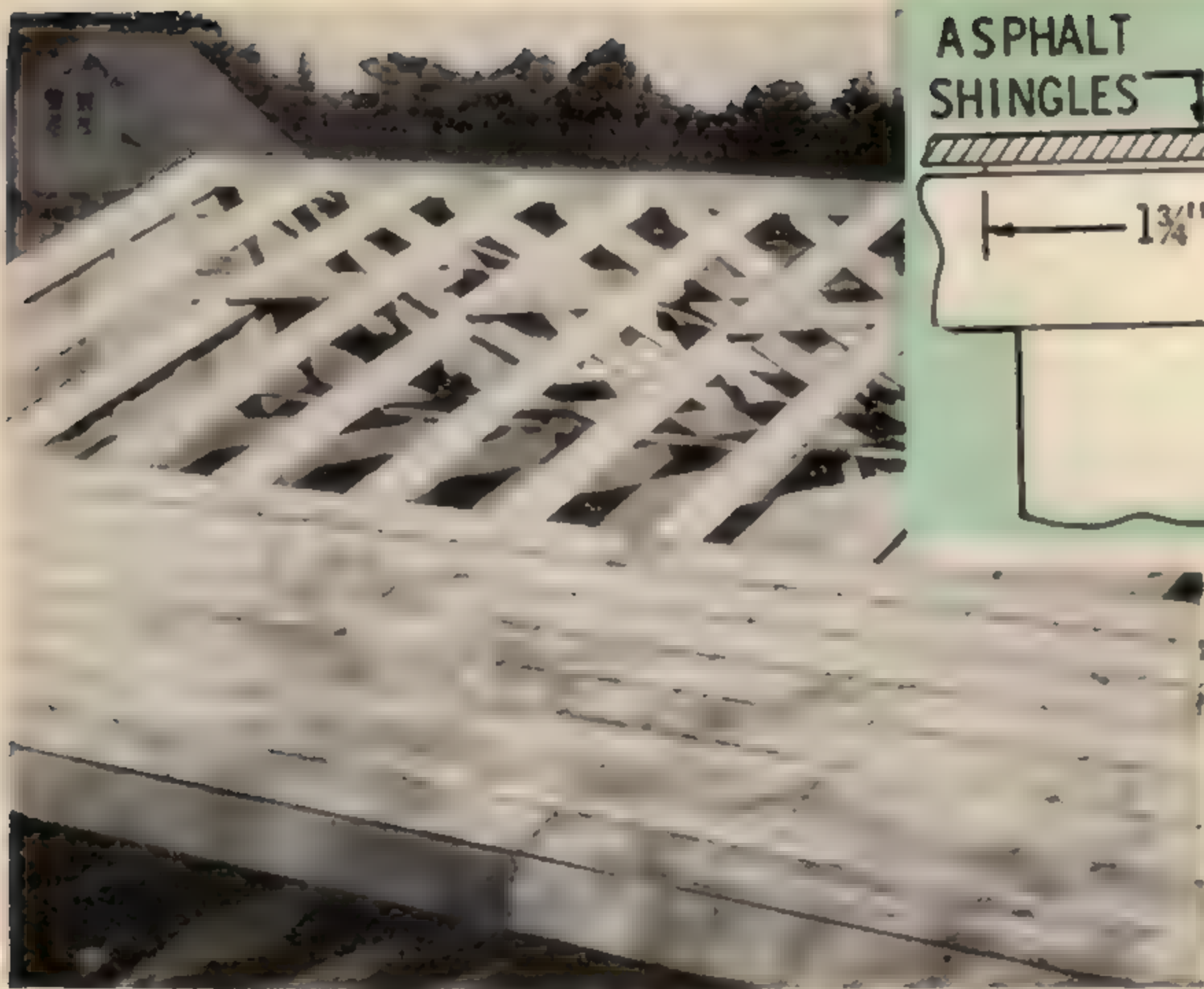
To ready yourself for shingling, distribute the packages across the roof, so you'll always have a supply at hand as you move along. The first row (at the eaves) is laid over a strip of 12-in.-wide roll roofing.

Once we got the garage space under cover, work could progress at a more

ARCHITECT'S PLANS

If you find that an architect's working blueprint is required to secure a building permit, you can obtain a standard 17 x 23-in. plan (Scale: 1/4"=1'0") by sending \$1 to *Popular Mechanics Magazine*, 575 Lexington Ave., NYC





WORK TOWARD RIDGE when applying shiplap, with open lap at upper edge. At each rafter, drive one 8d box nail through lap, second through opposite edge

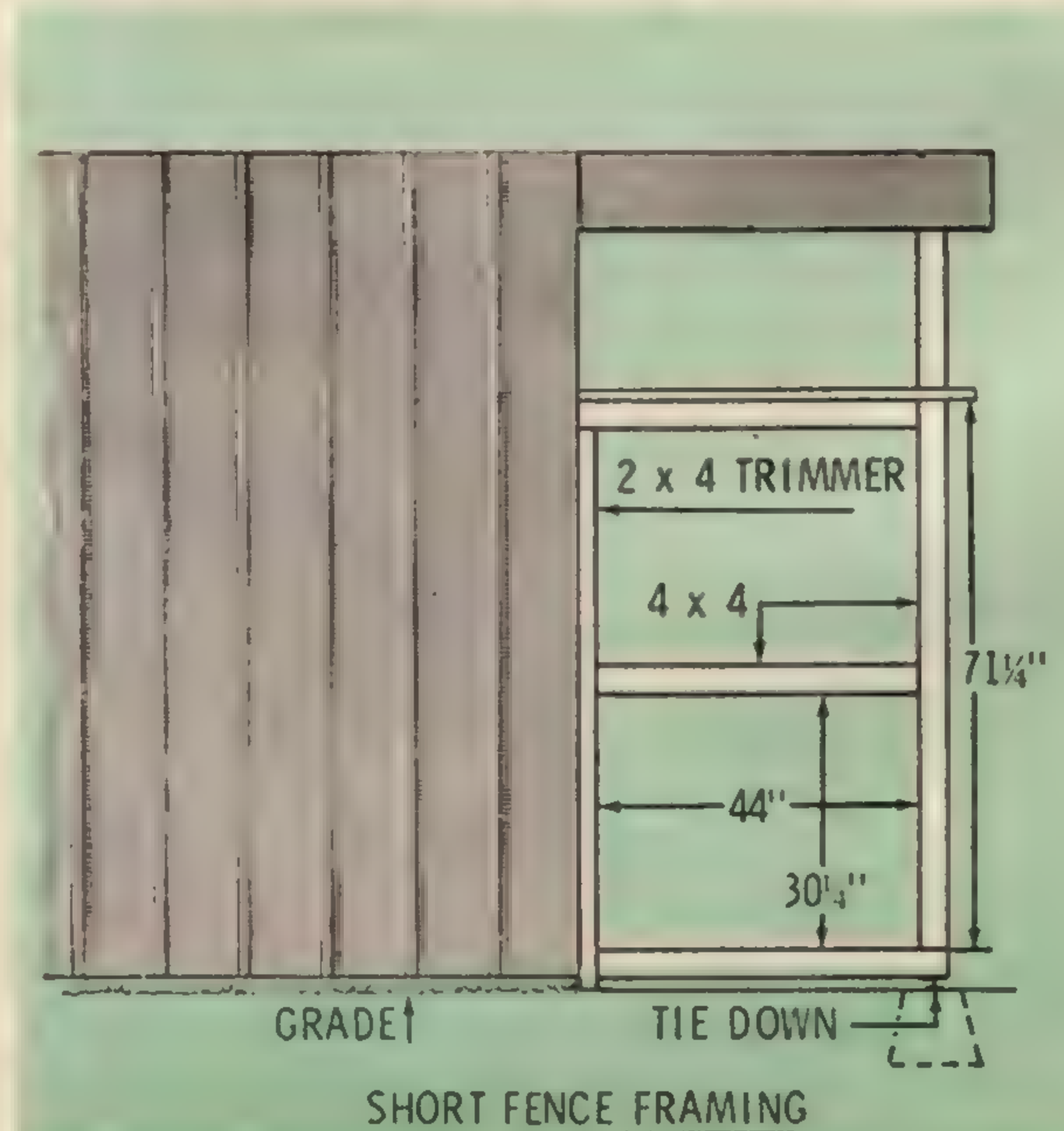
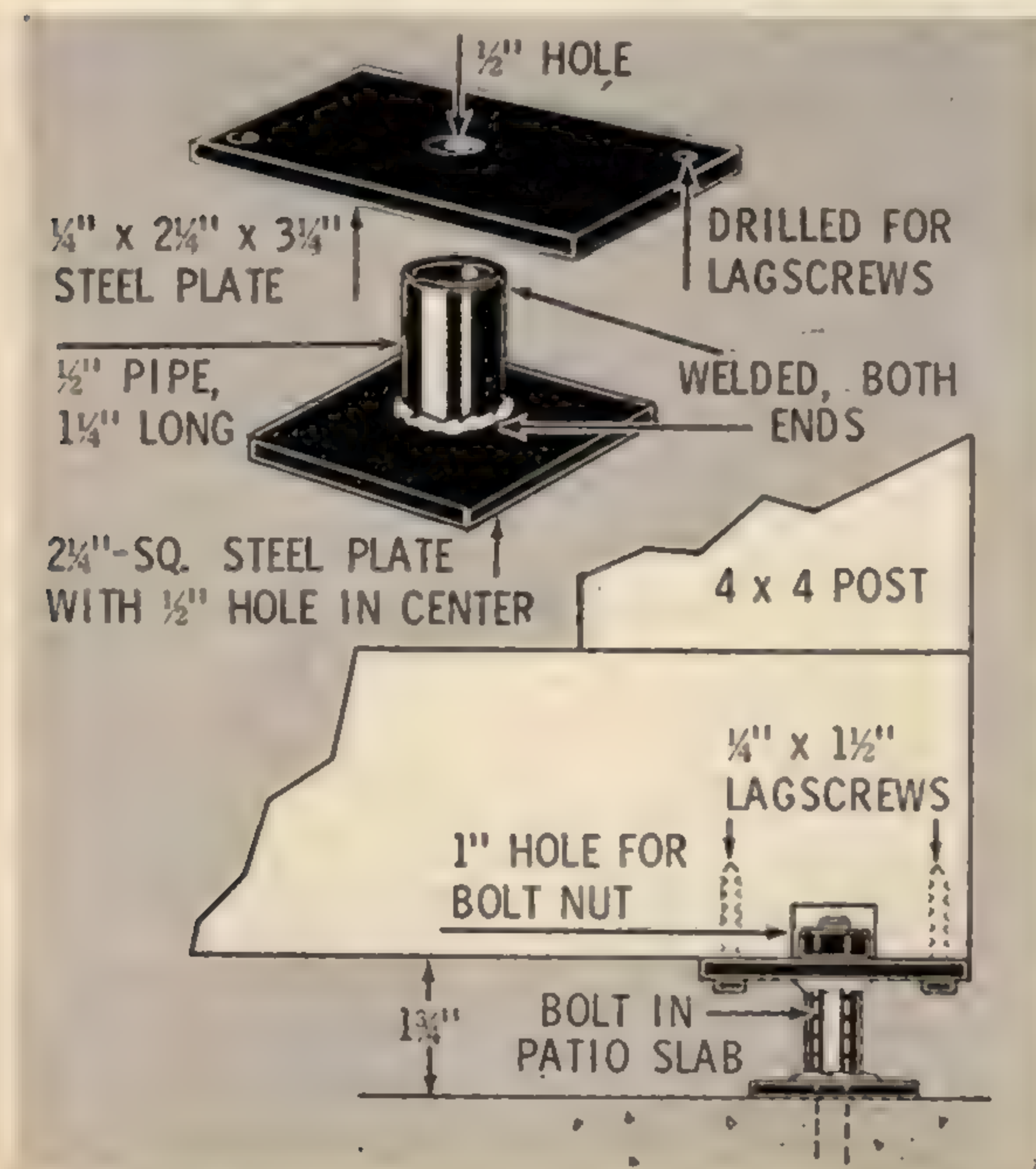
START SHINGLING at front corner to minimize waste caused by angled edge. Cut shingles back to form runnel (inset) to channel run-off to eave gutters

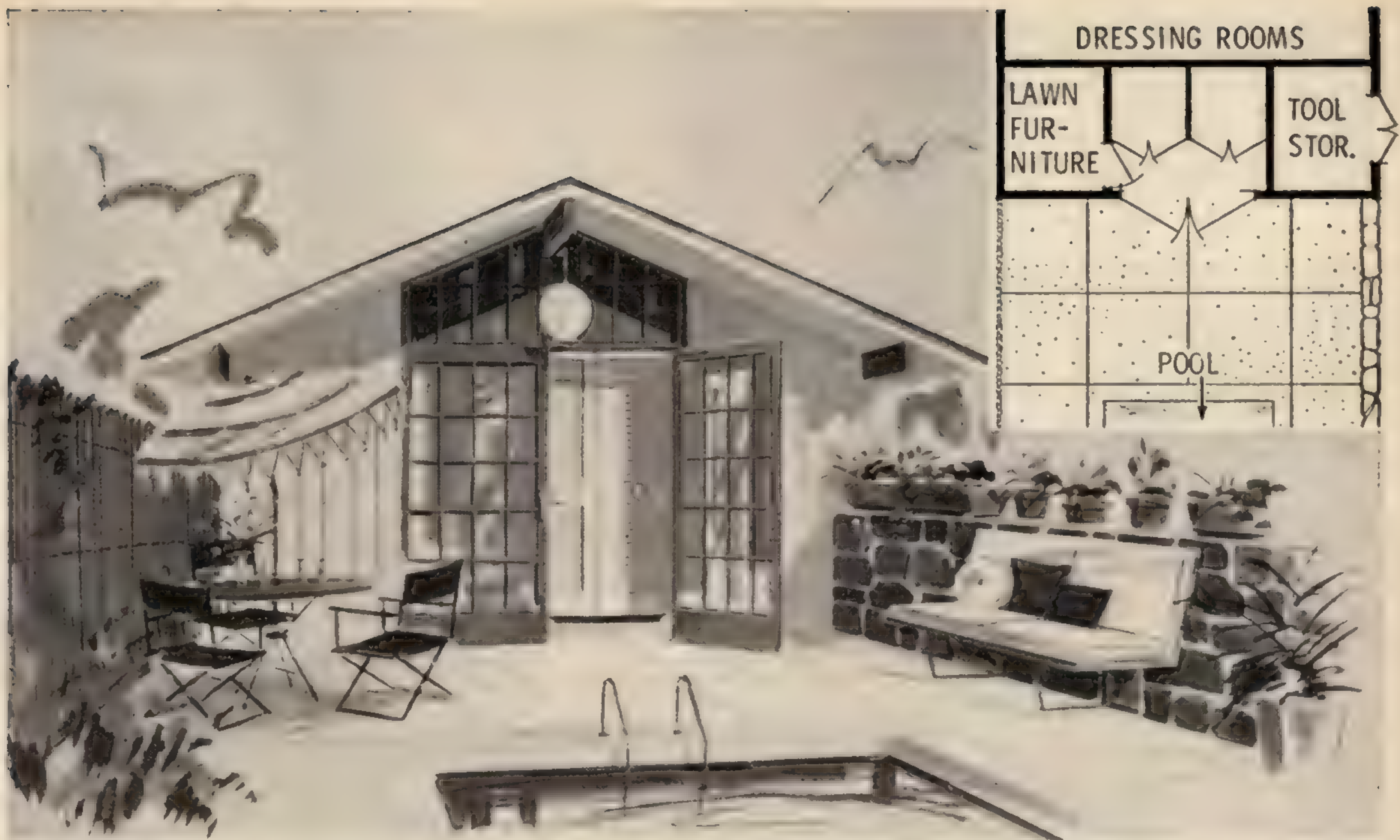
cheerful pace, without racing our local rainy season. We turned our attention to the patio privacy fences, and if you compare our details with the architect's blueprints, you'll see we made a few more changes. First, we added a 4-ft. return to the right end of the rear fence; by having it turn the patio corner, we not only increased privacy, but buttressed the fence against Oregon's heavy winds. I didn't tie the corner lamppost into the wall.

Nor did I follow the architect's specification of iron-pipe supports for the eave beams. I substituted 4x4 posts, which were simpler to incorporate into the fence framing. The same board-and-batten surfacing used on the garage walls was extended to the fences—but was applied to *both* sides of the framing.

Both the long, rear, corner-turning fence and the short front one (which runs

only to the support post) are anchored to the concrete by means of tie-downs welded from steel plate and 1/2-in. pipe, as shown in the detail below, left. The size of the plates isn't critical, as long as they're not wider than the fence-timber. The bottom plate, however, should be smaller, to facilitate driving 1 1/2-in. lagscrews up into the timber after the unit has been dropped over anchor-bolts previously embedded in the patio slab. At the time you drill 3/16-in. pilot holes for the lagscrews, bore other, larger holes far enough into the bottom timber to accept the projecting bolts and nuts. You need only one tie-down unit for the short fence—directly beneath the support post; you'll remember that we provided a 12-in.-deep footing here when we poured the patio. The opposite end of this fence is tied into a 2x4 trimmer nailed to the triple corner stud of the eave wall. The

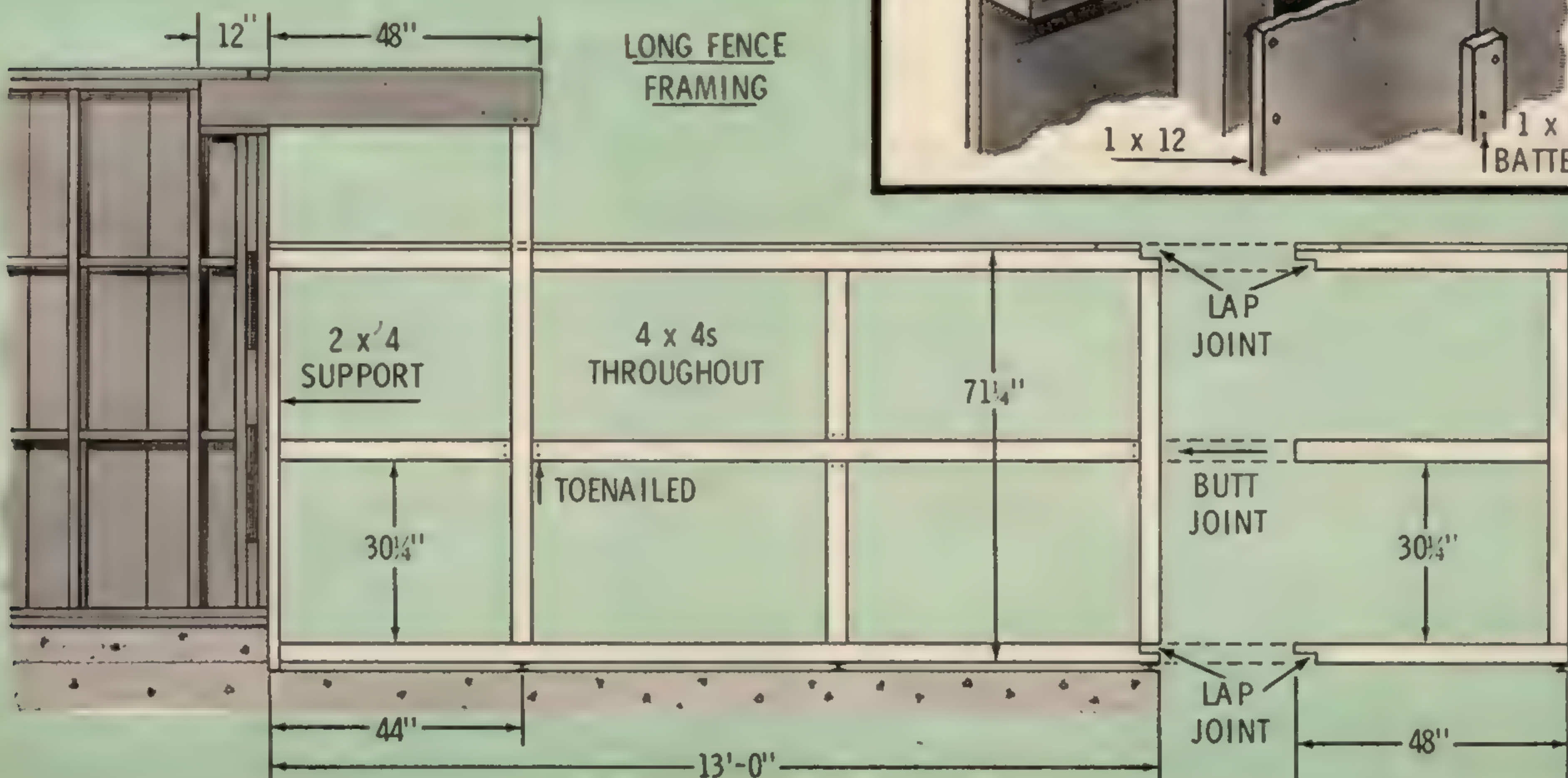
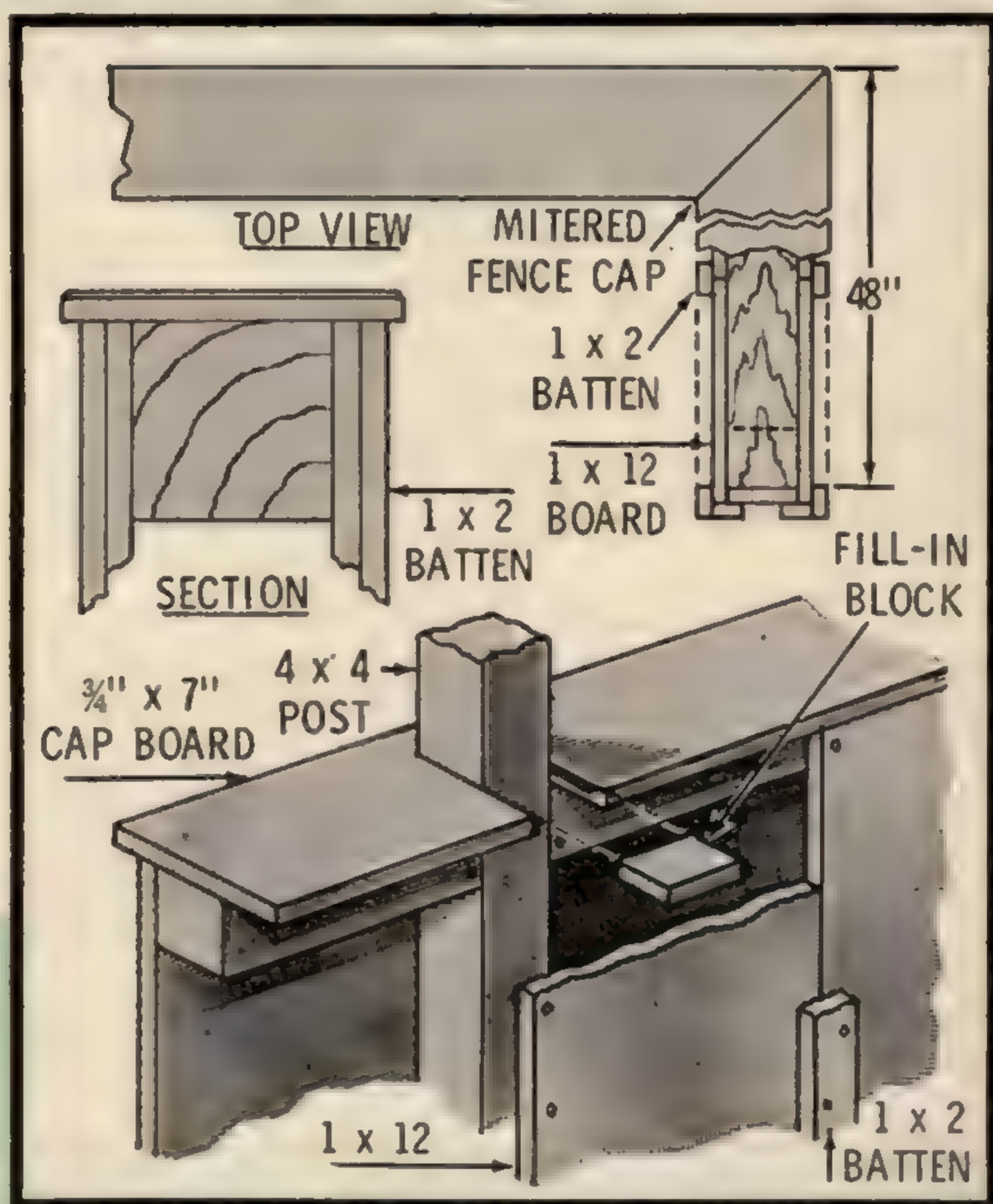




POOL-SIDE PATIO? Instead of kitchen alcove, your garage wall can include dressing rooms—lighted by glazed gable under overhang; glass doors optional

long rear wall is anchored to the garage the same way, and, again, you'll want a tie-down under the eave-beam support—and under the three other 4x4 posts.

You could now make use of both garage and patio. But, as you can see from the sketch of the finished garage on page 134, and from the floor plan in our April issue, that missing end wall gives the whole project its punch. It contains a sink alcove flanked by big storage closets, one of which is also the garage entry. Final plans will appear next month. ★★★





Pour-In-Place Floor

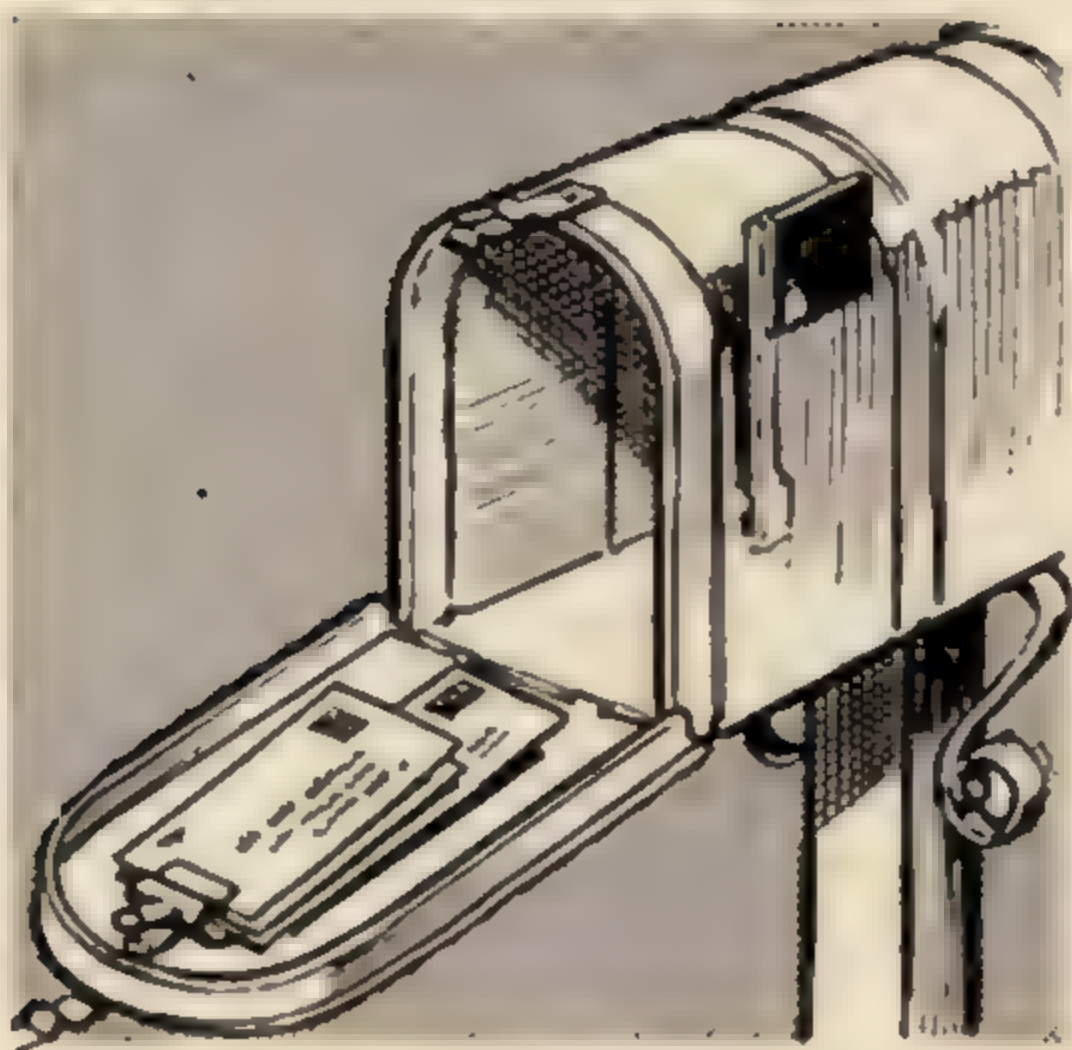
CALLED TORGINOL, this liquid terrazzo-like floor and counter covering is poured in four separate layers to produce a one-piece wall-to-wall nonskid surface that resists soiling and never needs waxing. A stiff molasses-like glaze, flowed on over

new or old floors, embeds and bonds colored chips in a glossy textured finish. The finished floor is from $\frac{1}{16}$ to $\frac{1}{8}$ in. thick, defies spike heels and can be used 8 to 12 hours after installation. Made by Torginol of America, Inc., Huntington Park, Calif.

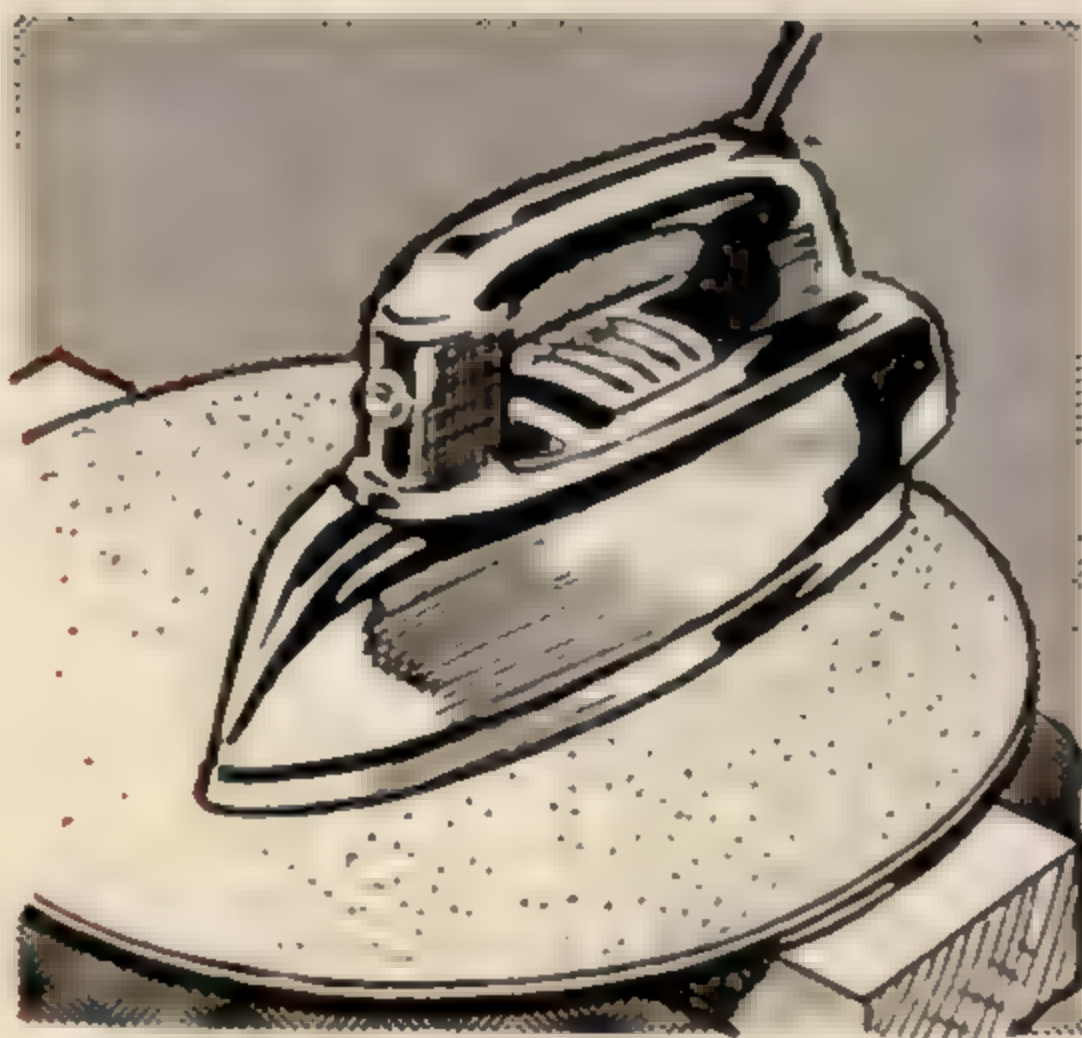
FIRST STEP shown in photo at left is to apply a base coat. After this has dried, a coat of clear urethane is mopped on and plastic color chips are scattered over the surface like grass seed. When dry, more urethane and chips are applied and the mixture is squeegeed. After drying, a final coat of clear glaze is mopped on



TAKE A HINT FROM READERS



WIN THANKS from your rural mail carrier by clamping all your outgoing letters together in a paper clamp. Don't attach clamp to box, since this makes it difficult to remove the letters



BY RESTING a warm iron on your sanding disc before pulling off the worn abrasive, the old paper will come off easier and the heat helps soften the sticky adhesive for holding new abrasive



SORTING BOLTS by length will take much less time if you make a length gauge by slipping the clip of a pencil down toward the point. Readjust clip to sort out different length bolts easily



TO AVOID accidentally tipping over a bottle of glue or acid on your workbench, drive two nails into a block of wood, place bottle between them and snap a rubber band around all three

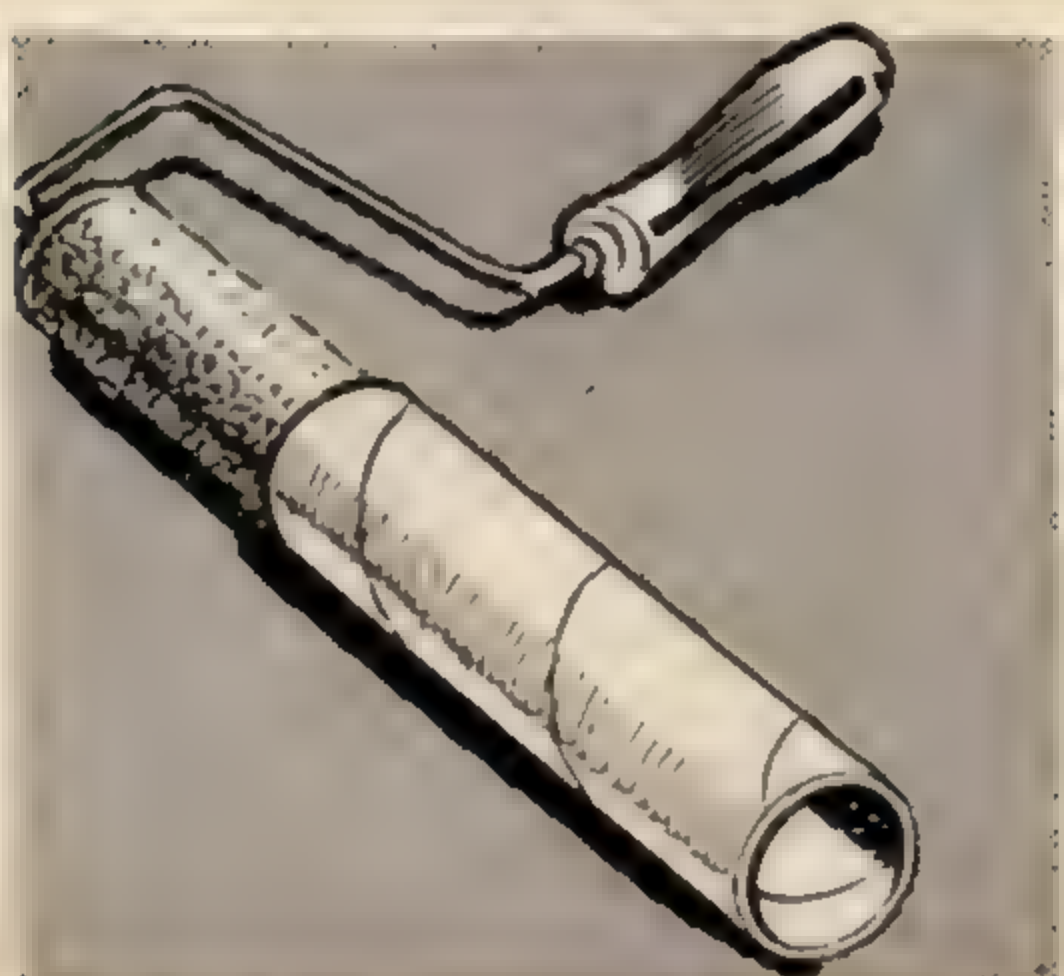


WHY BOTHER removing the filler cap of a gas can every time you want to pour out a little? Instead, punch a top vent hole opposite the spout and seal with a wad of modeling clay



SIMPLE HOLDER for artists' brushes can be made by filling the center of an empty tape spool with a rolled strip of corrugated cardboard. Brush handles will fit inside corrugations

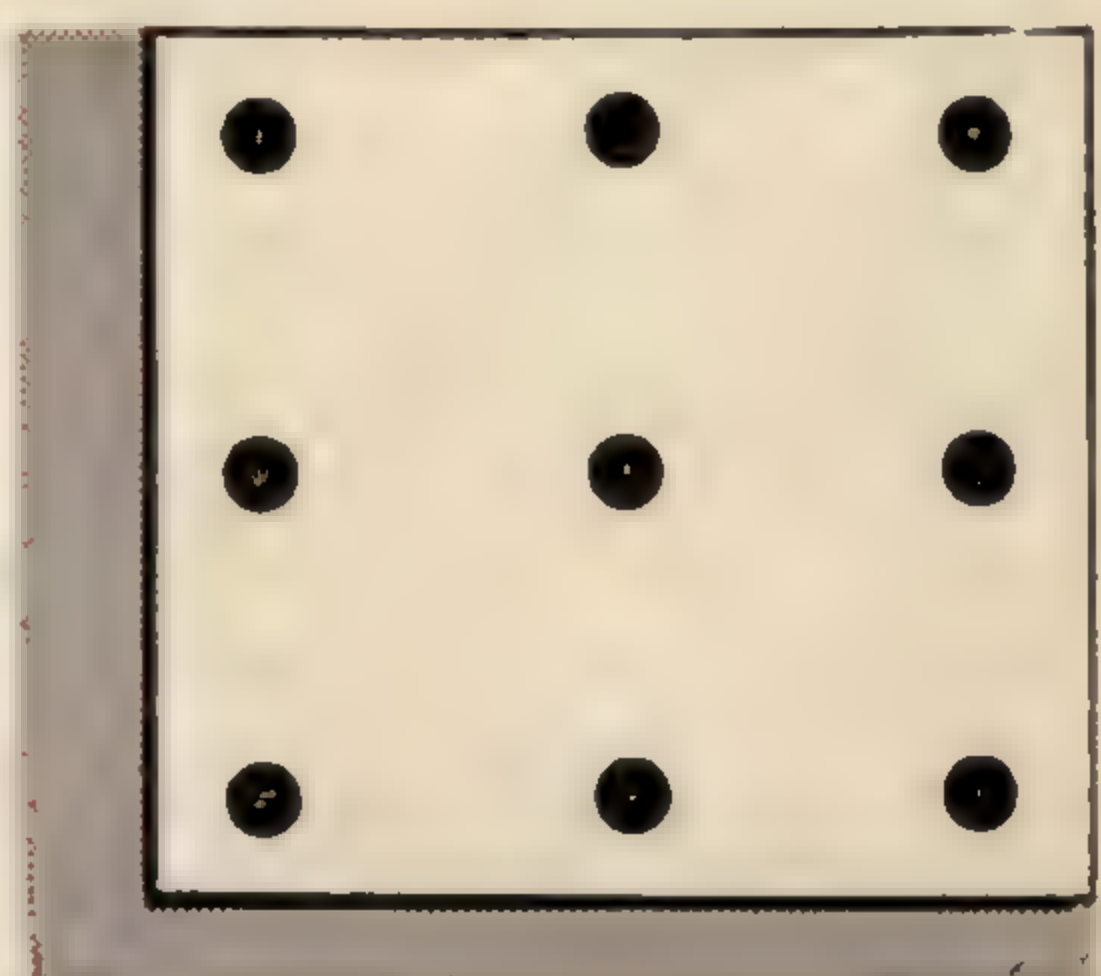
WHEN STORING a paint roller, protect it from dust or damage with a slip-on cover made by cutting a section from a mailing tube. Make cover slightly longer than roller to protect edges



CAUGHT WITHOUT a candle holder? In an emergency, you can improvise one by inverting a tea cup and dripping melted wax on the bottom to attach candle. It even has a handle



PUZZLE OUT this one. How would you connect all nine dots in the drawing below using only four straight lines? Give up? Turn to page 161 and you'll find the answer to this teaser





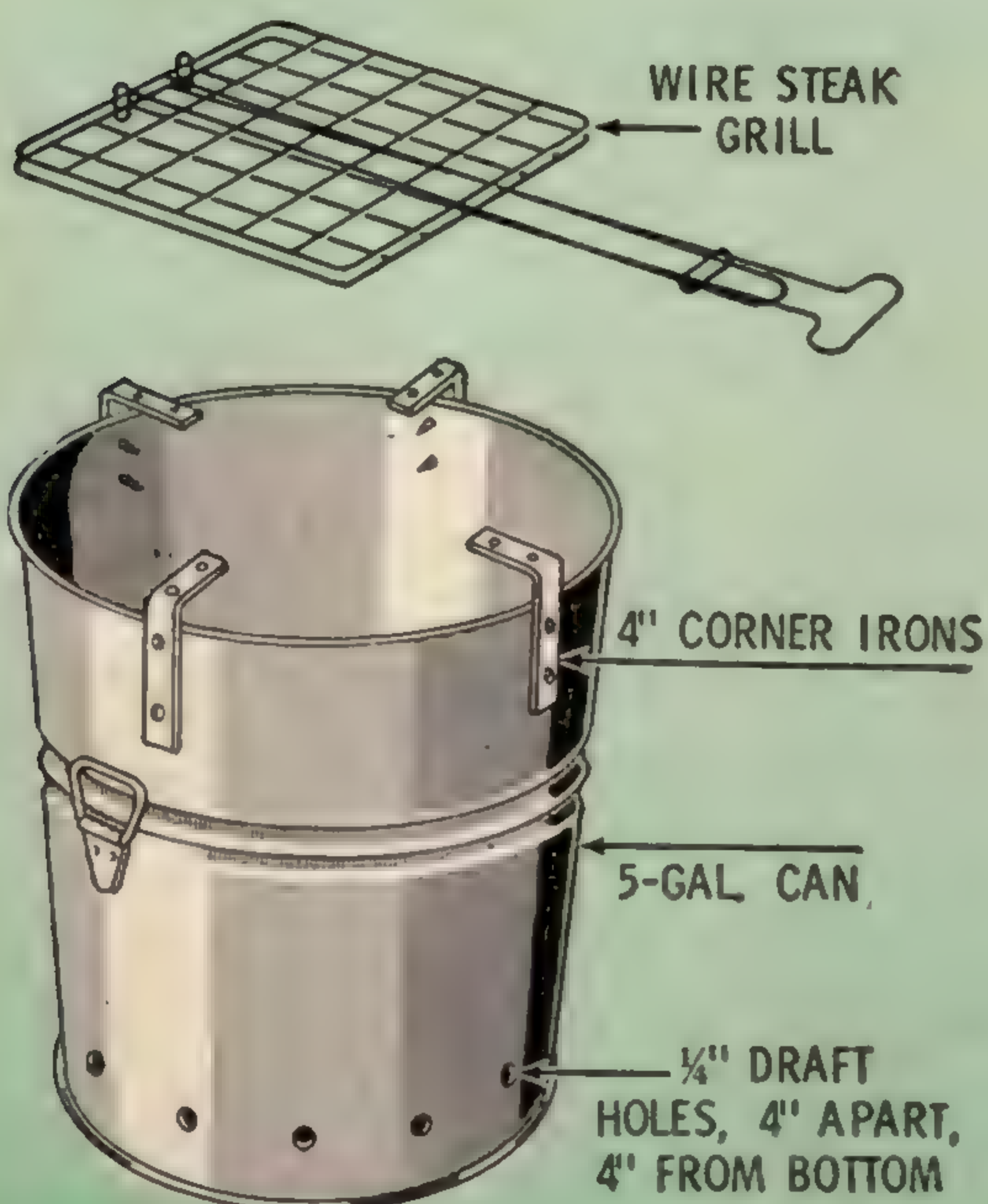
“Old Smoky” Barbecue

AUNT MAUD loved everything I cooked in my backyard barrel on her recent visit. “That flavor’s like nothing I’ve ever tasted!” she’d say, back for seconds. I didn’t have the heart to tell her that, before I converted it into Old Smoky, that barrel had been full of bourbon.

Actually, it’s the charred-oak interior that imparts the flavor—just as it helped flavor the whiskey. Want to try it for yourself? It’s not hard to convert the barrel, once you find one. If you have a liquor-bottling plant or distillery near you, you should be able to pick up a used 50-gallon wine or whiskey barrel for around \$5. If not, some bourbon makers will ship you a barrel. They must dispose of used ones, since bourbon must, by law, be aged in a numbered oak keg which can’t be reused.

What you must do to make the barrel respectable depends on its condition. You

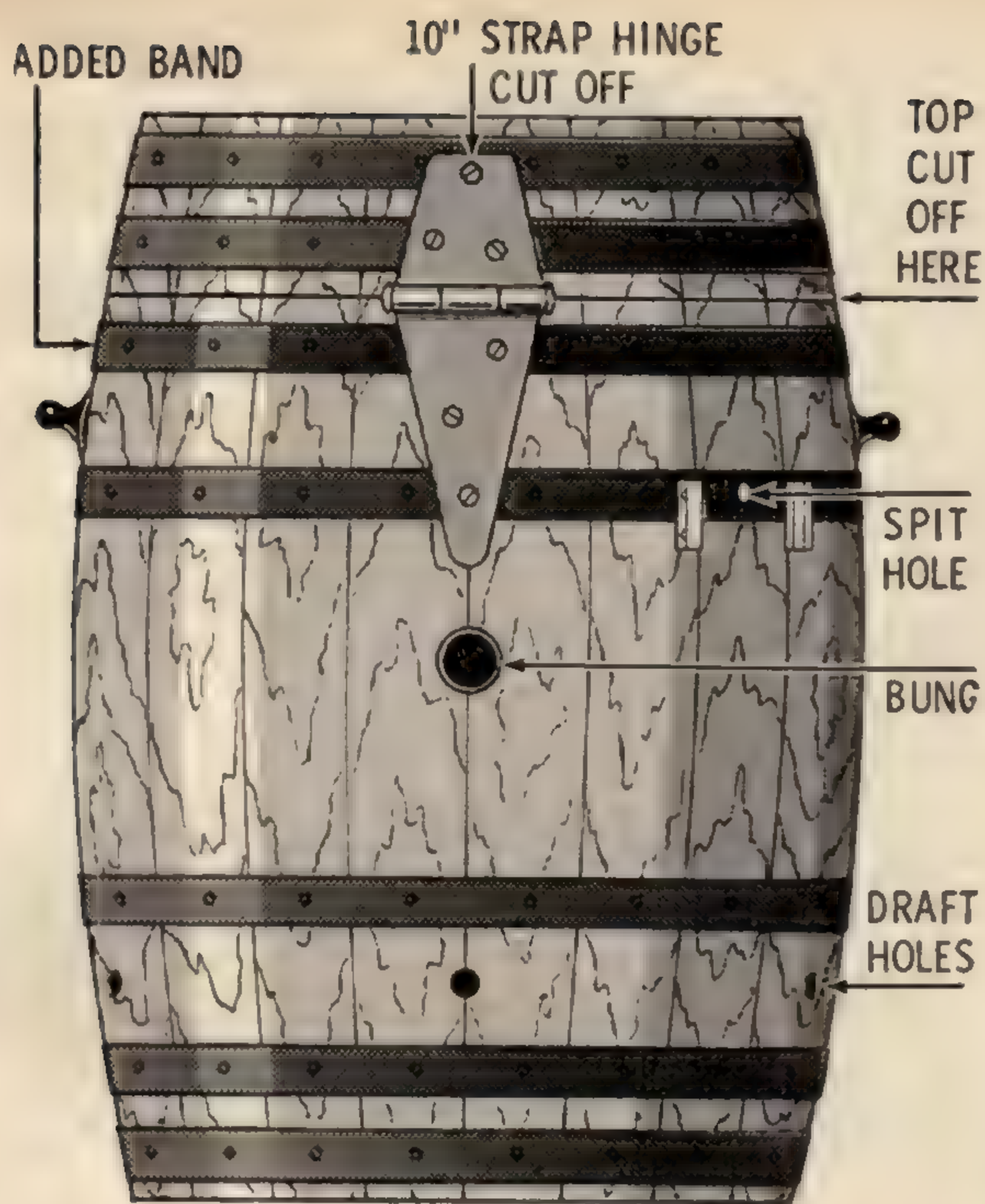
Grill Uses Wadded Newspaper for Fuel



AN OUTDOOR GRILL using balls of newspaper for fuel can be made at little cost from an empty five-gallon can. Containers of this type are often used for packing lard or potato chips.

Four steel angles are attached to the top edge of the can to support the standard steak grill. A ring of $\frac{1}{4}$ -in. holes spaced 4 in. apart are punched about 4 in. from the bottom of the can to provide draft.

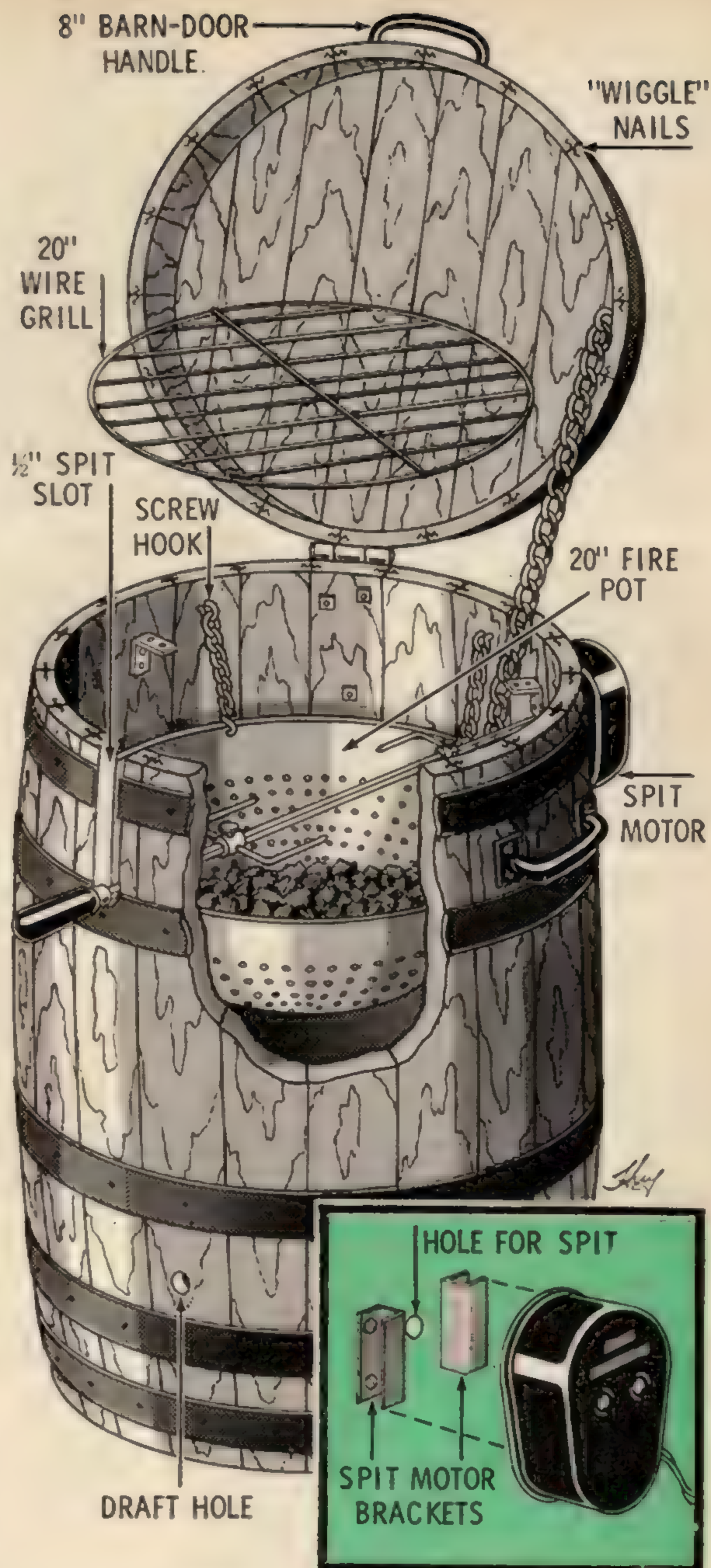
When you’re ready for a cooking session, crumple double sheets of newspaper to form six balls about the size of grapefruit. Toss them in the can and ignite. Their hot, searing flame will cook hamburgers in 6-10 minutes. Drippings of fat falling in the fire help to furnish additional heat. For best results, don’t trim chops or steak before cooking; if the meat is lean, top it with bacon strips or cooking oil.—R. L. Taylor



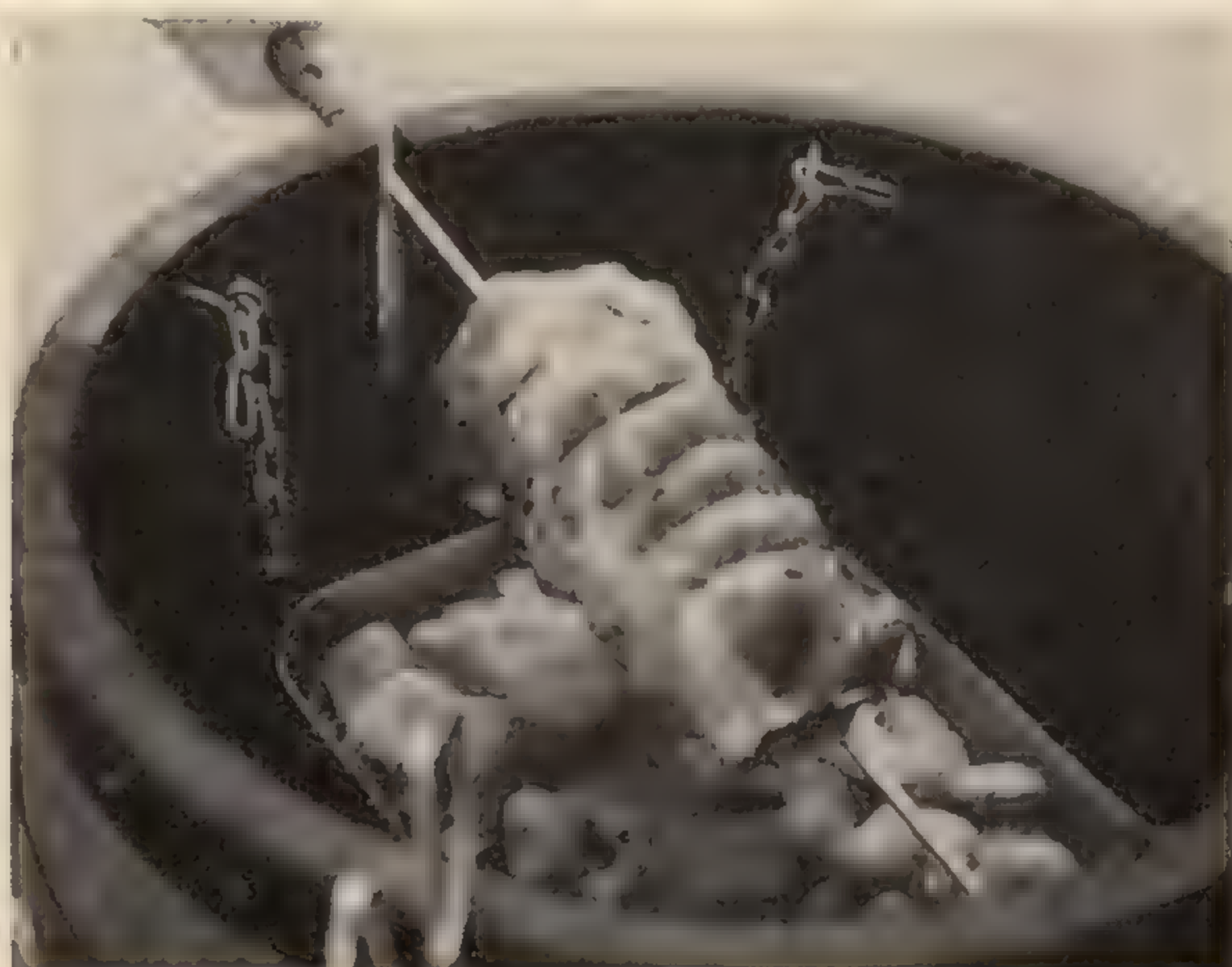
50 GAL. OAK WHISKEY BARREL
APPROX. 24" DIA., 33" HIGH

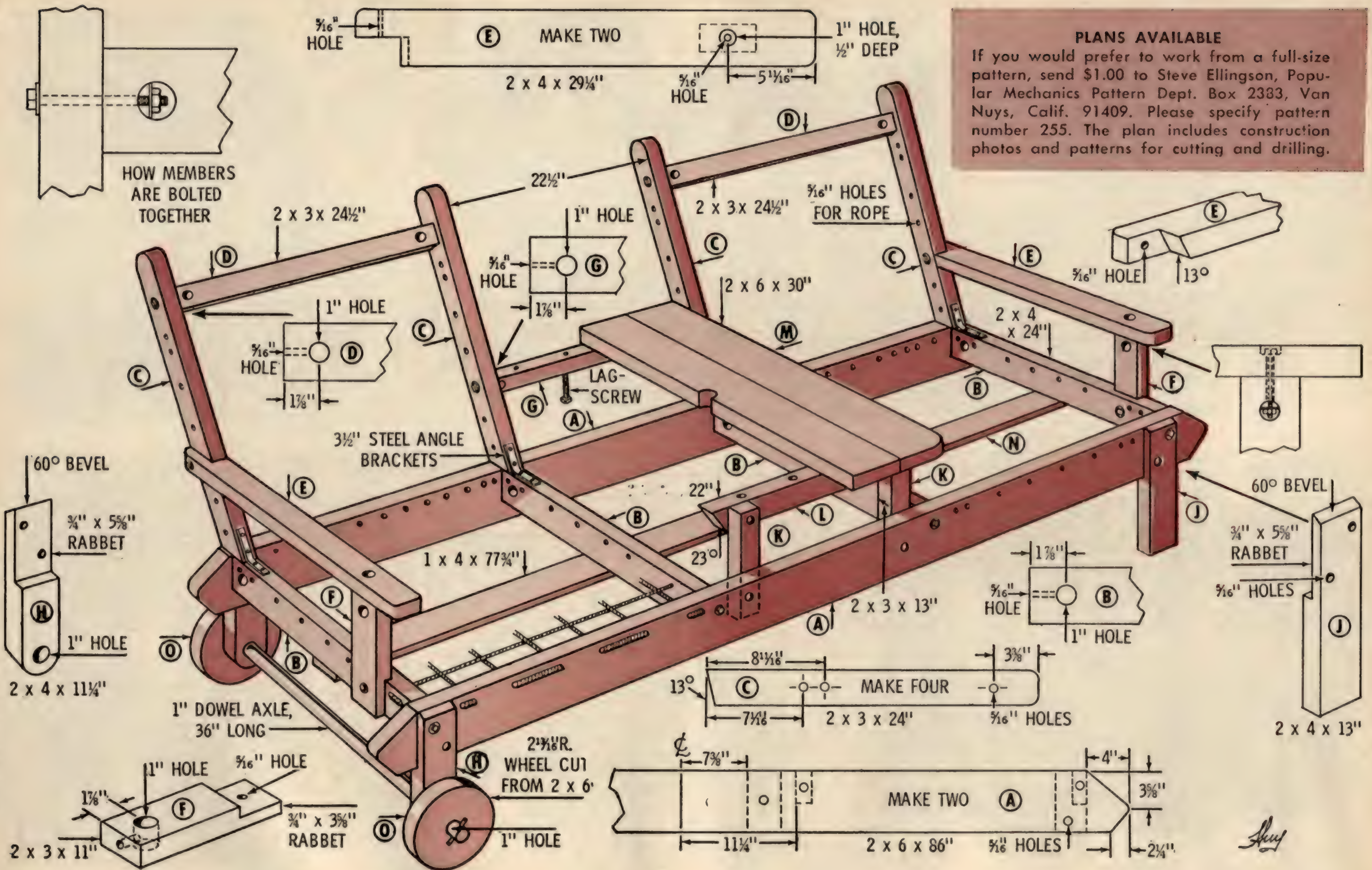
may want to sand its weathered exterior and apply spar varnish. You'll probably have to secure the hoops with screws, as shown in the photos—and you may even have to add a hoop, if yours aren't spaced as shown. Ideally, you saw the barrel in two just above the third hoop. After cutting, drive corrugated fasteners into the ends of the staves, to bridge the joints between them. Locate the spit slot about 8 in. to either side of a point directly opposite the bung. You'll have to cut this slot through the upper hoop with a hacksaw; if possible, end the slot by nicking into a lower hoop with a file, to seat the spit. Then drill a hole through that same hoop, just opposite the slot, to pass the spit through to its motor connection. Pour a couple of buckets of sand into the barrel to catch embers that drop from the firepot.

—M. F. Hauserman, Jr.



TWO COOKING METHODS—grilling (below left) and spit-turning—can use different fire pots. Both 20-in. colander, and bake pan with draft-holes in bottom, are hung on chains, permitting height adjustment







Tete-a-Tete on Wheels

ANY PART of your patio or lawn becomes a conversation corner when you truck out this handsome double-chair-and-refreshment-table combo. Should wind or rain come up as you sip and sun, you merely furl and lift free the umbrella, then "wheelbarrow" the unit to a sheltered spot by raising its right end.

For durability, redwood is the best material, though you could use pine, finishing it with exterior enamel. On good-grade, well-seasoned redwood, no finish is required, unless you prefer the look and touch of an oiled surface.

Assembly is by means of carriage and machine bolts, and lag screws. Note that machine bolts are used wherever the nut must be inserted in a 1-in. hole into which the bolt projects—as when joining the front and back rails to the four cross members. You can't use a carriage bolt here; since the nut must be held stationary, tightening must be done by turning the head with a wrench.

To keep the table top clear of bolt-heads or nail holes, the four table planks

are anchored by means of lag screws driven up through cleats G and L *from below*. Longer screws are required at the front, since cleat L is set on edge.

The back-rests slant 13 degrees off vertical; this angle influences the cuts at the bottom end of parts C and the rabbets in Part E. You'll also have to adapt four 3½-in. corner angles by spreading them wider to serve as braces. Drill 5/16-in. holes through the seat frames as shown, to lace the rope. Secure the ends with knots, inside, and stretch as tight as possible, treating seats and backs separately.

—Steve Ellingson

MATERIALS REQUIRED

REDWOOD, with part key (and no. needed)	DOWELS
2 pcs 2x6 x 8'—A & O (2 each)	1 1"x36" (axle)
1 pc 2x6 x 10'—M (4)	1 ¼"x6" (2 pegs)
1 pc 2x4 x 10'—E, H, & J (2 ea.)	BOLTS (washers, nuts)
1 pc 2x4 x 8'—B (4)	4 5/16"x4½" machine
2 pcs 2x3 x 6'—D, F, K (2 ea.), G & L (1 ea.)	12 5/16"x3½" machine
1 pc 2x3 x 8'—C (4)	8 5/16"x4" carriage
1 pc 1x4 x 8'—N (1)	6 5/16"x3" carriage
	4 5/16"x3½" lag screws
	8 5/16"x2½" lag screws
	Approx. 100' ¼" rope



Sawbuck Magazine Rack

By

Art Youngquist

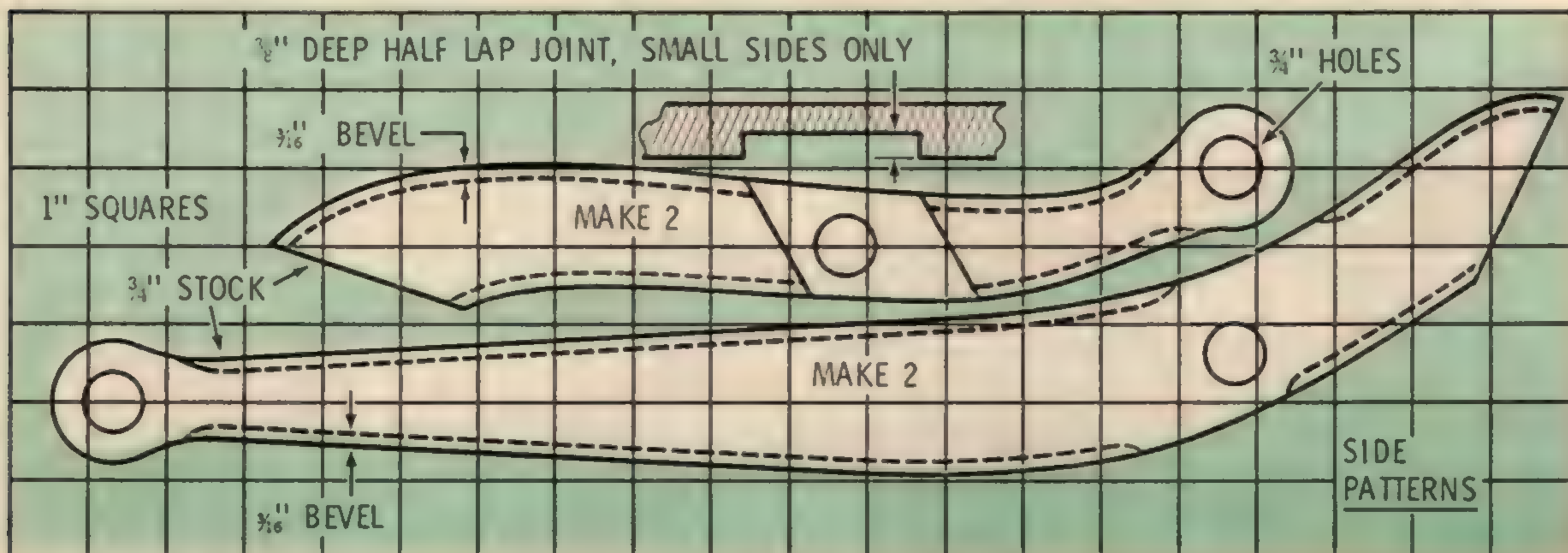
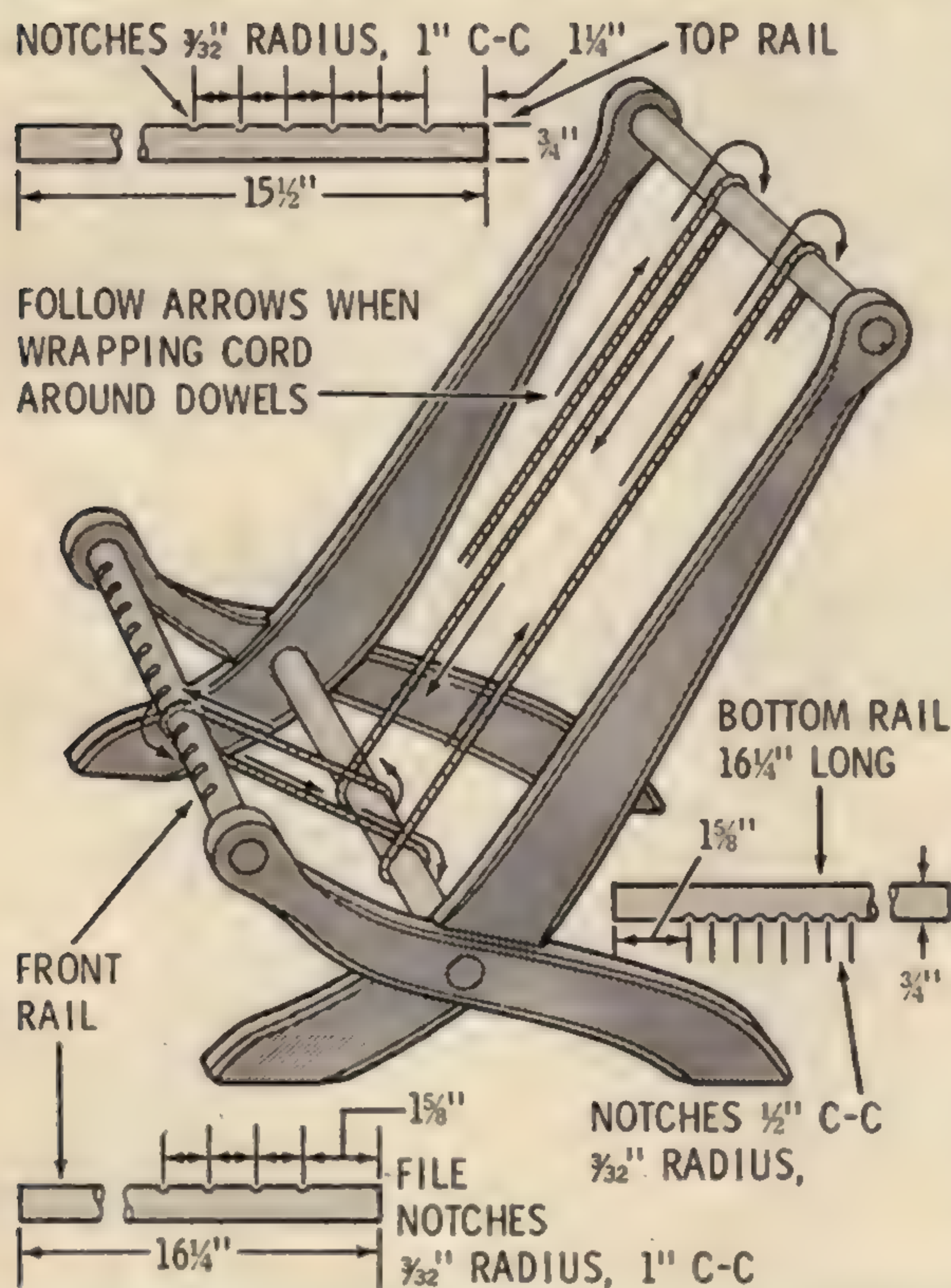
THANKS TO its graceful, uncluttered design, this novel magazine rack blends well with either modern or traditional furniture.

Begin construction by drawing full-size plans for the two side pieces on a sheet of cardboard, using the grid pattern shown below. Cut out these patterns and trace the design on $\frac{3}{4}$ -in. hardwood stock. To avoid danger of splitting, drill the dowel holes before cutting the parts on a band- or jigsaw. The locations for the holes can be marked by driving a small nail through the cardboard. Clamp matching pieces together so they may be filed and sanded simultaneously. Then separate the pieces and chamfer the edges, both sides, with a file or portable router.

Assemble the sides temporarily with three $\frac{3}{4}$ -in. dowels, and mark the locations of the half-lap joints. Cut and reassemble with glue and brads.

To keep the venetian-blind cord neatly in place, notches are filed in the dowels, spacing them as indicated in the drawing. One end of the cord is anchored in the first notch of the bottom rail with a tack and the lacing proceeds as shown in the drawing at the right.

An attractive finish can be produced by applying three coats of 50-50 orange shellac and alcohol, rubbed down with 4/0 steel wool between coats. Two coats of paste wax will protect the finish.



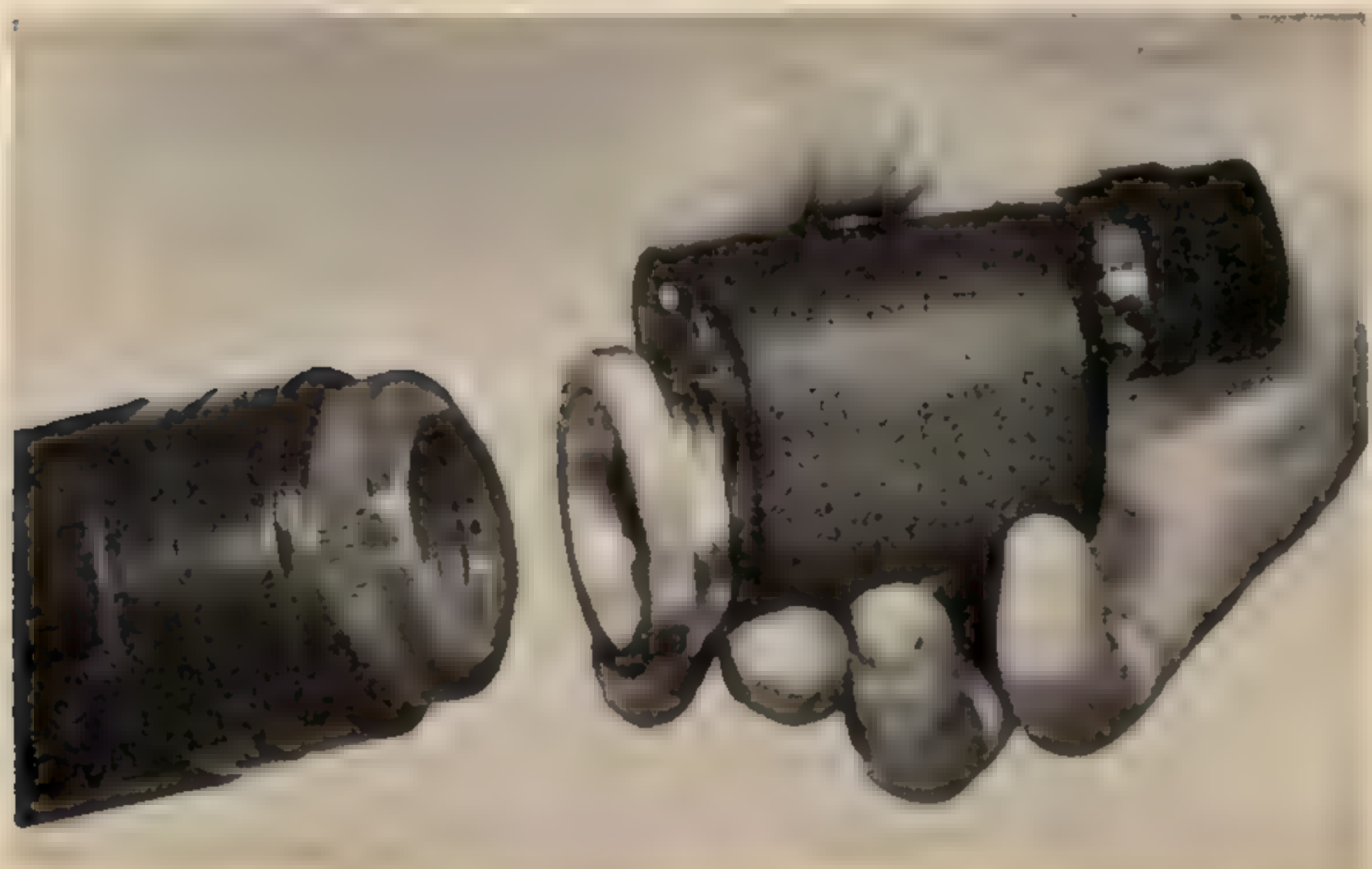
New for Camera Buffs

Prolong Gas is said to prevent oxidation of developers and replenishers. Before capping a bottle of solution, you shoot some gas into it, thus driving out any air. The gas, being inert, won't react with the chemicals. Works with either color or black-and-white solutions. Prolong sells for \$1.75, from Century Laboratories, 2222 Lunt Ave., Elk Grove Village, Ill.

Handy Computer will save a lot of time and test strips for users of Polycontrast enlarging paper. If you want to print a negative in more than one contrast grade, this device tells you what exposure to use with each Polycontrast filter. Retail price is 25¢, at camera stores. Produced by Eastman Kodak Co., 343 State Street, Rochester 4, N.Y.

Accurate Focusing is easy with the Bolex Zoom Reflex P-4 8-mm movie camera. When you look into the viewfinder, you see two separate images. By turning the focusing mechanism to superimpose these images, you focus the image on the film plane. The f:1.9 lens of this camera zooms from 9 to 36 mm. Retail price is \$275. Pailard, Inc., 1900 Lower Rd., Linden, N.J.

Telephoto Lenses become telescopes with the T-Scope (shown below). This attachment, which amounts to a monocular without an objective lens, fits or adapts to many photographic lenses. Use it with a 100 or 105-mm lens and you get a 12-power telescope. A 200-mm lens becomes a 24-power scope, etc. Costs under \$20. Accura, Ltd., 708 Byron Ave., Franklin Square, N.Y.





TROUBLESHOOTING Outboard Carburetors

Whether your outboard problem is a washboard idle or a dead engine, if it can be traced to the carburetor, you can fix it

By Henry B. Notrom

PITY THE POOR CARBURETOR! It's the most cussed, most worked-on-for-no-reason and probably the least understood part in an outboard engine.

Actually, the carburetor on a small to medium-size outboard is one of the simplest engine parts to service. With the larger engines, however, it's another story entirely. Many of today's big outboards are equipped with carburetors that can almost match a hot automotive carburetor in complexity. Let's make it clear at the outset that such carburetors require the tender care of a trained mechanic, so unless you have a very high opinion of your skill, better not tamper with them.

The only purpose of an outboard fuel system is to deliver a fuel mixture to the cylinders. This mixture is pumped from the tank up through a hose by the fuel pump, which is merely a pulsating diaphragm that sucks in fuel on one pulse and pushes it out on the other. On the push-out pulse, fuel's shoved through another line directly to the carburetor fuel bowl. But it's not a steady flow.

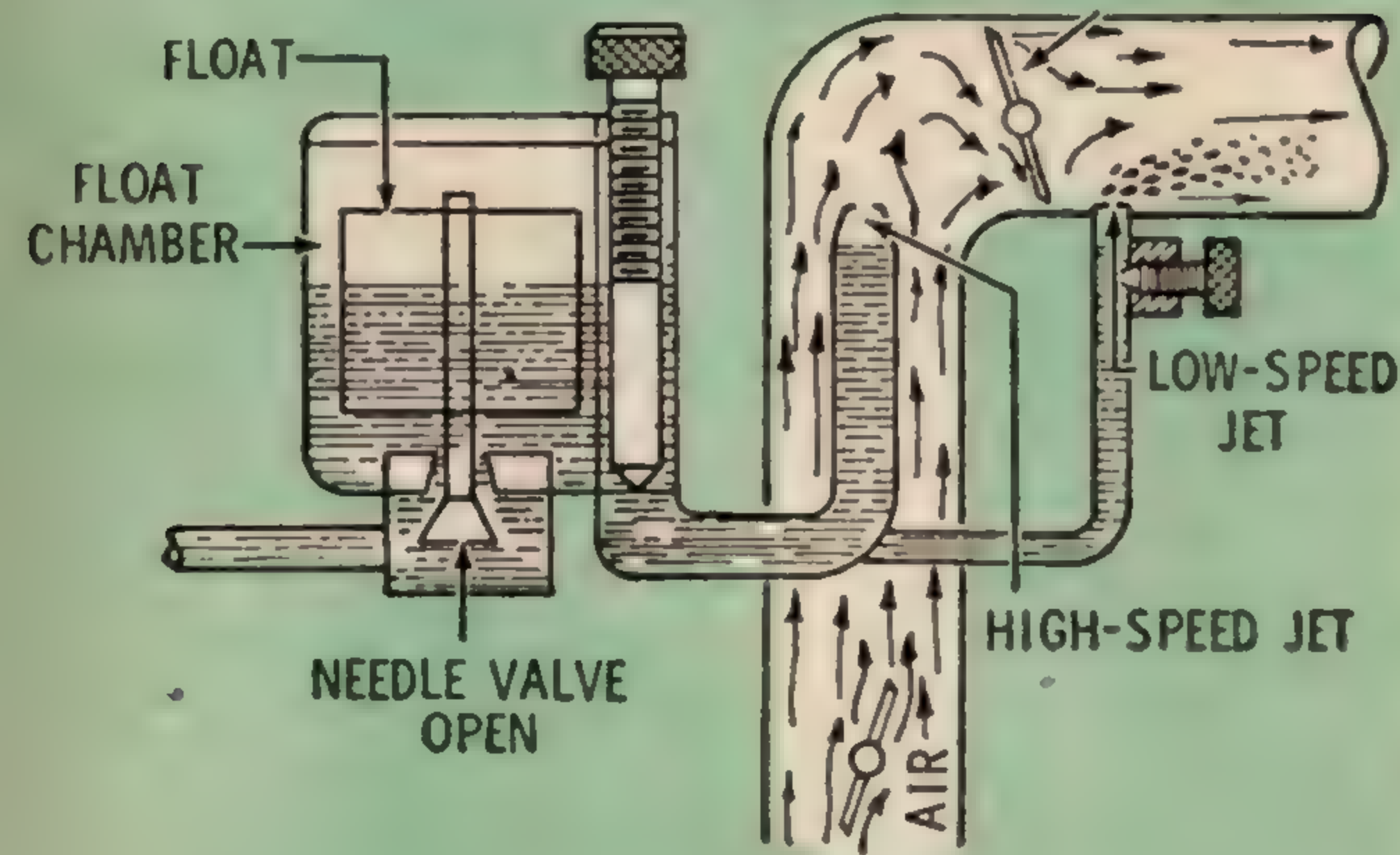
A sophisticated little device called a float and needle valve assembly regulates the flow, and it works exactly like the float assembly in a toilet tank.

When you flush a toilet, water streams out the tank and the float drops, opening the intake valve. The same thing happens in the carburetor bowl. As fuel is consumed, draining the bowl, the float drops and allows the needle valve to leave its seat, opening the way into the carburetor.

When a toilet tank fills with water, the float rises on the water and shuts off the

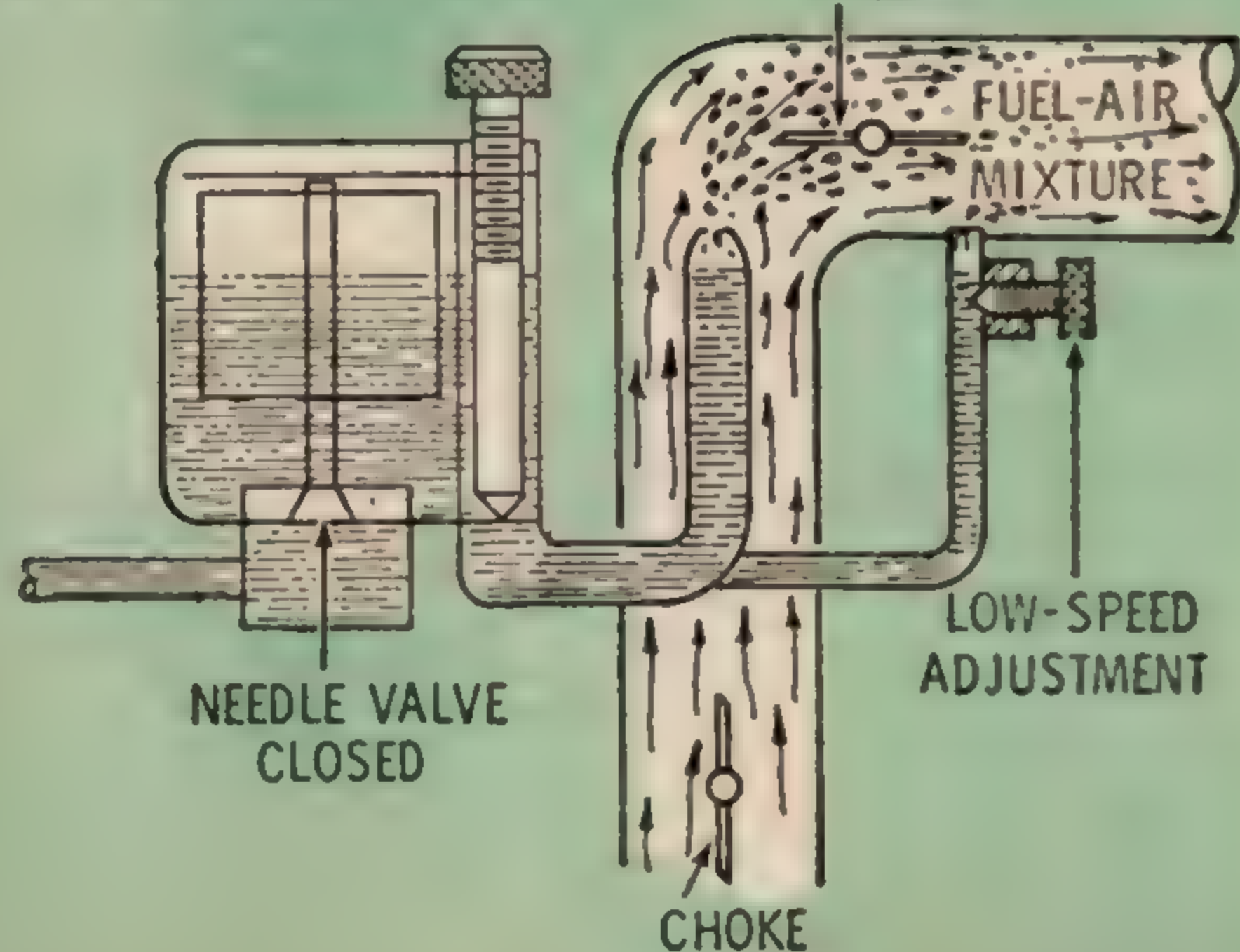
LOW-SPEED OPERATION

THROTTLE VALVE CLOSED



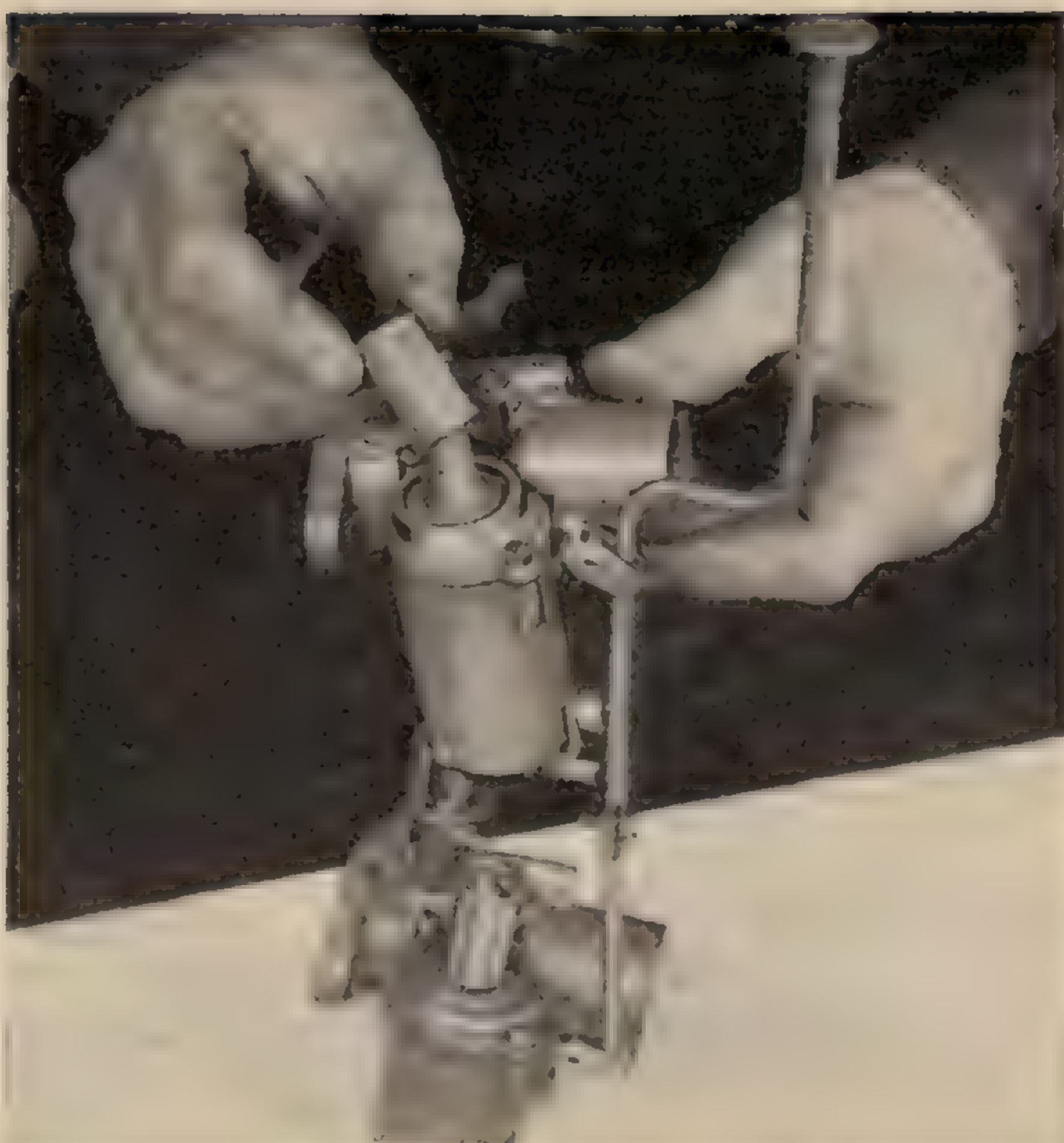
HIGH-SPEED OPERATION

THROTTLE BUTTERFLY OPEN





FUEL FILTER on this Mercury carburetor is hidden under a cover which must be removed for servicing



METAL FILTER, such as this one, can be cleaned by washing in kerosene, seldom requires replacement

intake valve when the water reaches its top level. In the carburetor, the float rises as fuel fills the bowl, pressing the needle valve against its seat.

In modern carburetors, fuel flows from the bowl into the carburetor air tube (or venturi) through a non-adjustable, fixed high-speed jet in just the right amount at which your outboard will run most efficiently. Older carburetors had metering valves that had to be adjusted.

The fuel squirts out the high-speed jet and is picked up by the tremendous rush of air going through the venturi, the result of vacuum created by the stroke of the piston. This fuel-air mixture is rammed into a cylinder where it's burned.

Engine speed is controlled by the throttle butterfly. At low throttle, the butterfly partially blocks the flow of mixture to the cylinder. As speed is increased, the butterfly opens to allow a greater quantity of fuel into the cylinder.

Since outboard engines are variable speed types, a low-speed circuit is required to keep the engine running smoothly at idle and very low speed when the carburetor throttle butterfly is practically closed. This is nothing more than a branch passage from the high-speed flow to a jet on the *cylinder side* of the throttle butterfly. When the throttle butterfly is at idle position, some air flows around it and picks up the fuel being tossed into the air stream by the adjustable low-speed jet. At high speed, the great rush of air passing over the low-speed jet keeps its output down to a trickle. If it didn't, flooding could result.

There are only three things that can happen should your outboard's fuel system go on strike:

- The engine won't start, or it starts but stalls when any throttle is applied.
- The carburetor floods (phew!—you'll smell it).
- The engine won't idle properly—stalls or revs too fast.

The most deceiving of the three, of course, is an engine that won't start. The trouble doesn't have to be the fuel system, so here's where your diagnostic powers really get a workout.

You know that if fuel's getting to the cylinders, but the engine won't start, the trouble has to be elsewhere. How do you find out? Give the engine two or three revs to prime it and remove a spark plug. If it's wet and smells of gas, don't blame the carburetor for your troubles (unless,

IN SOME ENGINES, it's possible for the carburetor gasket to swell enough to block fuel passages



DISMANTLING YOUR CARBURETOR



CARBURETOR COVER contains needle valve assembly which is controlled by float through two levers



TO RELEASE needle valve, remove pin in the primary lever. Clean in kerosene; replace if badly coated

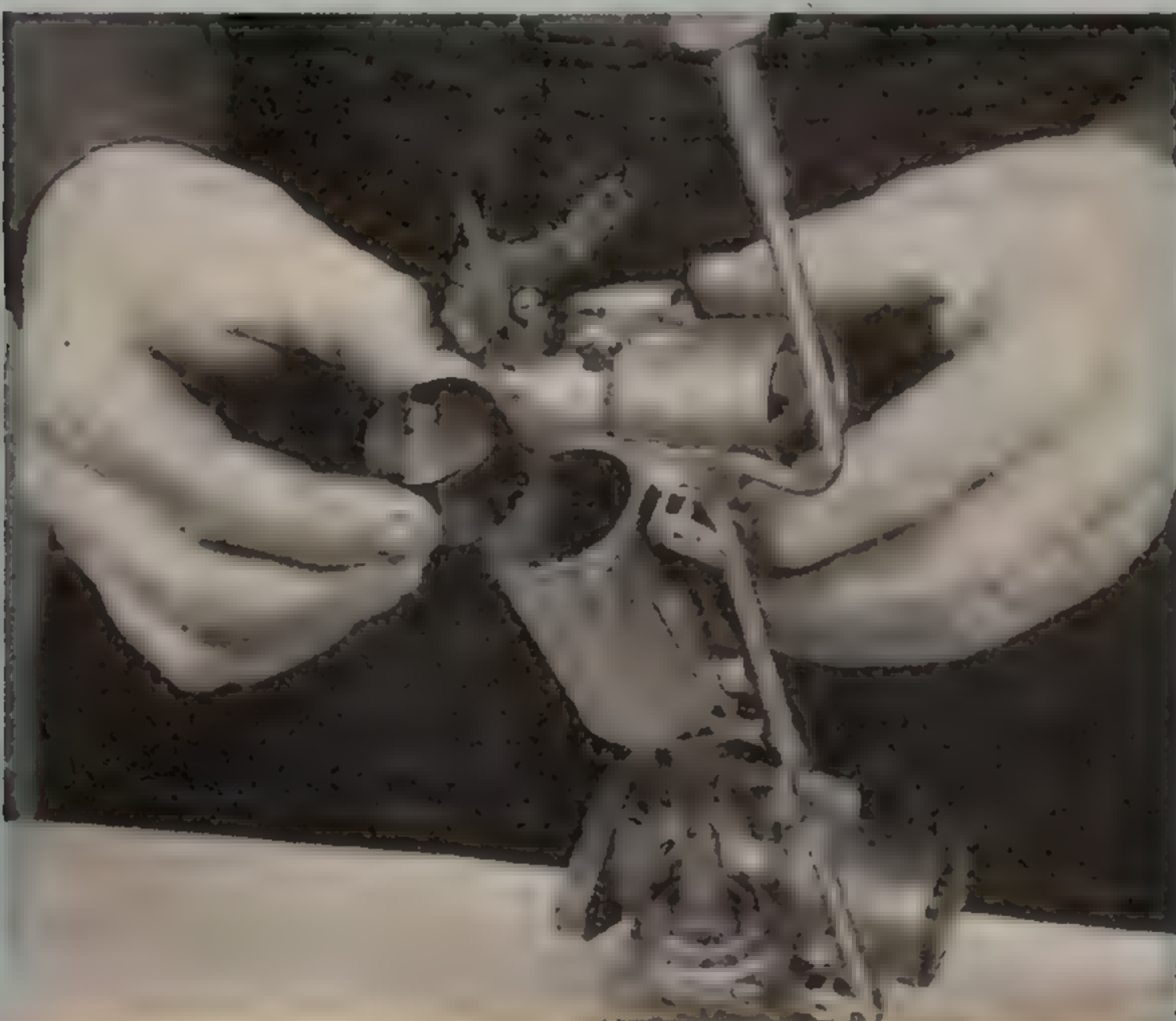


NEEDLE VALVE SEAT can be unscrewed after removing secondary lever. If coated with varnish, replace



AFTER REASSEMBLING valve and seat, adjust levers until they are perfectly parallel, bending as necessary

REMOVE FLOAT and check the spring unit at the top. This activates needle valve and may need adjustment



SPRING TOO HIGH or low starves engine or floods it. Specs said $\frac{13}{32}$ in. was right height for this one



of course, it's flooding the engine and the plug's soaking wet). Your problem's probably ignition.

If no fuel's getting through, the trouble could lie anywhere from the fuel tank to the aft end of the carburetor. Experience has shown that most often the trouble is either in the fuel filter or the needle valve in the carburetor bowl, but try the simpler possibilities first.

Check your fuel lines. They might have twisted around and kinked, interrupting the flow of fuel. Mercury engines have a sharp setup that makes this check a snap. Black fuel lines have a white stripe running down the side and white fuel lines have a black stripe. You can easily spot if lines are twisted by checking this stripe to see if it's straight.

If the lines are okay, test to make sure fuel is getting to the carburetor. Disconnect the line running between the fuel pump and the carburetor line at the carburetor, wrap the end in a rag and pump the primer ball at the fuel tank. If the rag comes away wet, the trouble's in the carburetor—most likely a faulty needle valve.

Chances are, though, the rag will be dry, indicating that fuel's not getting to the carburetor. If so, remove the fuel filter housing and take out the fuel filter. If it's a metal type, as on many Mercury engines, wash it out in kerosene. If it's a ceramic type, as used on many Outboard Marine engines, discard it for a new one.

By the way, although we show removal of the fuel filter with the carburetor off the engine in the illustration, this is only for clarity's sake. All filters can be removed with the carburetor on the engine. The filters of Mercury carburetors are generally located on the carburetor, those of OMC engines are usually located at the carburetor side of the fuel pump.

One other thing could be preventing fuel from reaching the carburetor—a badly shot fuel pump diaphragm. But it's most unlikely that a diaphragm will suddenly develop a hole big enough to do this. What usually happens is that the diaphragm develops a pinhole. When this occurs, the engine runs okay at low speed, but stalls out at higher speeds—that pinhole prevents the diaphragm from delivering enough fuel to meet the high-speed fuel needs of the engine.

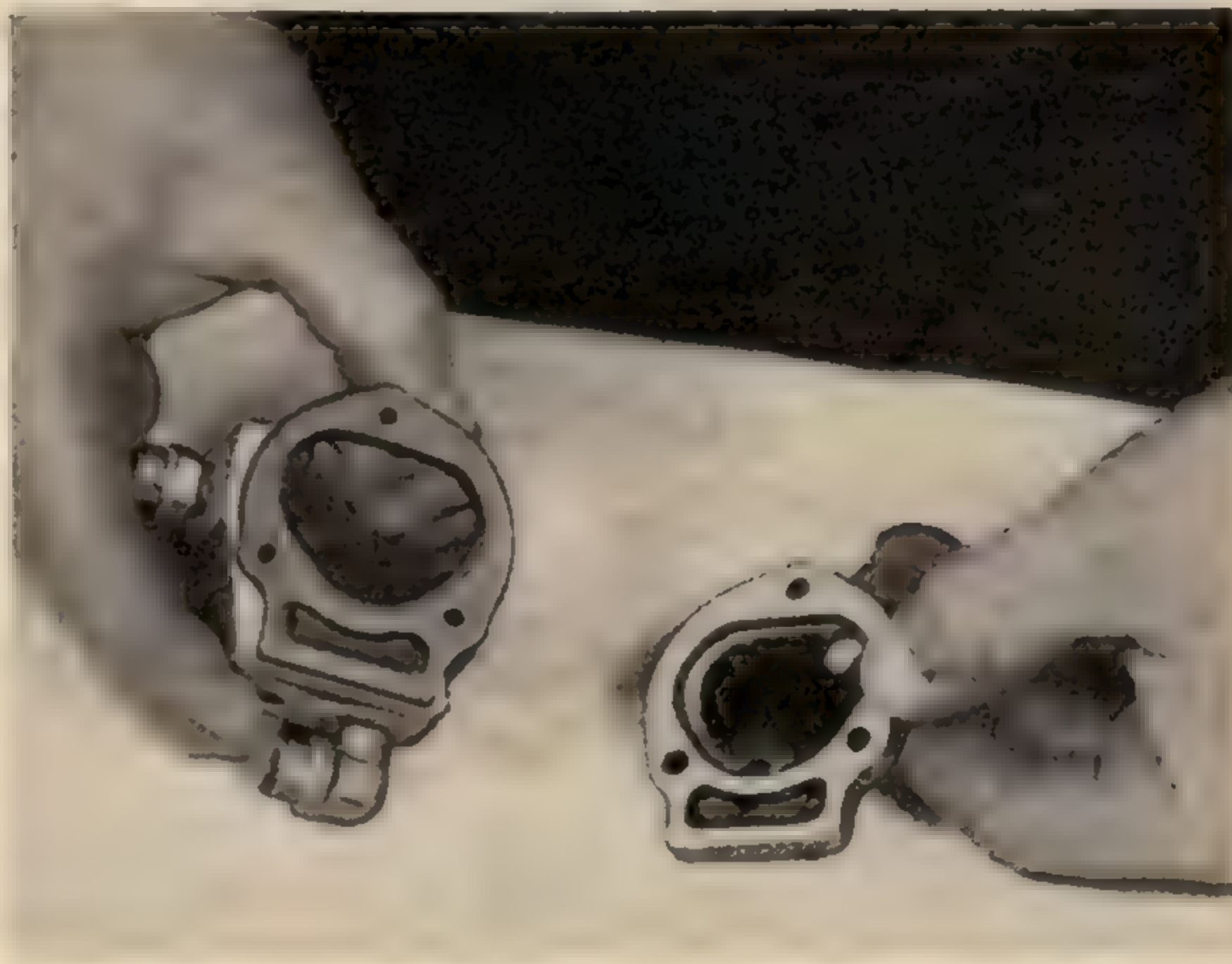
If this seems to be the problem, change diaphragm. It can usually be done with the pump in the engine. Simply unscrew the housing cover to get at the diaphragm, which is encased between two gaskets. Rip off the old gaskets and diaphragm, and put in new ones.

There's one other long-shot possibility



DIAPHRAGM in fuel pump is held between two gaskets. Once housing is opened, all three must be replaced

NEW GASKETS and diaphragm can be installed in just a few minutes, will probably cure fuel-pump problem



that could be preventing fuel from reaching the cylinders, but it applies only to the carburetor type shown on page 150, which is off an OMC engine. The carburetor gasket between the float chamber and air tube could swell in size, blocking off the fuel from the fuel passages. Generally, when this happens you can't get the engine to idle properly, but seldom will it completely stop the flow of fuel.

To replace the gasket, the carburetor must be split apart, which means taking the carburetor off the engine.

Before going on, we ought to mention that you're quite likely to find more than one carburetor on your engine. For instance, two-cylinder Mercs have only one carburetor, but Kiekhaefer's four-cylinder engines use two, as shown here, and their six-cylinder engines use a three-carburetor setup. OMC carburetors are different in design, but contain the same parts and are tackled in the same way.

The time to rip into a carburetor is when it's flooding, which usually means

Outboard Clinic

Q The sparkplug lead of my 1963 Mercury outboard has chafed badly at the magneto stator plate. I intend to install a new one, but what caused this to happen and how can it be prevented in the future?—A.B., New York

A Chafing and subsequent shorting out of the sparkplug lead on Merc 60, 110 and 200 engines are caused by the movement of the fly-wheel against the lead. Engines produced after the trouble became known have had a lead wire shield installed on the magneto stator plate. If such a shield is not on your engine, have one put on as outlined in service bulletin 2, section IV, dated Aug. 20, 1963. The shield for the 200 engine is different than the one for the 60 and 110 engines. The latter is offset to provide clearance for the fly-wheel.

Q In working on my Evinrude 18-horsepower Fastwin, I found a metallic deposit between the center and ground electrodes of a sparkplug which, I assume, accounts for the poor performance. What is it and what causes it?—D.H., South Carolina

A That's called either "core bridging" or "gap bridging" and, yes, it can result in bad engine output. It's caused by deposits in the combustion chamber which, in nine out of ten cases results from that old outboard bug-a-boo—improper gas-oil ratio. The bridging, though, could also come about from an excessive build-up of carbon inside the engine because of prolonged use without service or from gunning the engine to high speed after it's been used mostly for trolling. I'd install a new plug and try the fuel-oil ratio theory first—it's the most likely reason for your engine's bad behavior.

As a service to the readers of *POPULAR MECHANICS* in solving problems relating to their outboard engines, you are invited to submit your questions to this column. All questions will be answered, either in the column or by mail. Address Outboard Clinic, Popular Mechanics Magazine, 575 Lexington Avenue, New York, New York 10022 and enclose a 5-cent stamp.



LOW-SPEED ADJUSTMENT screw should be run in all the way, then backed off about $\frac{3}{4}$ turn for proper idle

that the needle valve is stuck open or the float level adjustment is off. The whole operation is detailed in the photos on page 150. Keep in mind that basic procedure is the same no matter what kind of carburetor you encounter.

To adjust the float in the carburetor shown above, the carburetor is first inverted so the float drops down. The edge of the gauge is placed on the housing and the measurement is made to the float. Measurements vary from carburetor to carburetor, but a service manager at an agency dealing in your engine will be happy to tell you what that specification is.

That leaves us with one other problem to solve—what to do if your engine doesn't idle properly. Try running in the low speed adjustment screw all the way and then back it off $\frac{3}{4}$ of a turn. In most cases, this will straighten out the idle. But if it doesn't and you have the type of carburetor pictured being ripped apart, remove the adjustment screw, insert the nozzle of an air pressure hose into the opening and blow dirt from the passage.

If you have the other type of carburetor and it refuses to idle after making the adjustment, don't forget about that carburetor gasket. Replacing it will usually solve the problem. ★★★

OTHER TYPE of carburetor commonly used today can be disassembled same way as that shown on page 151



Barrel Bronco

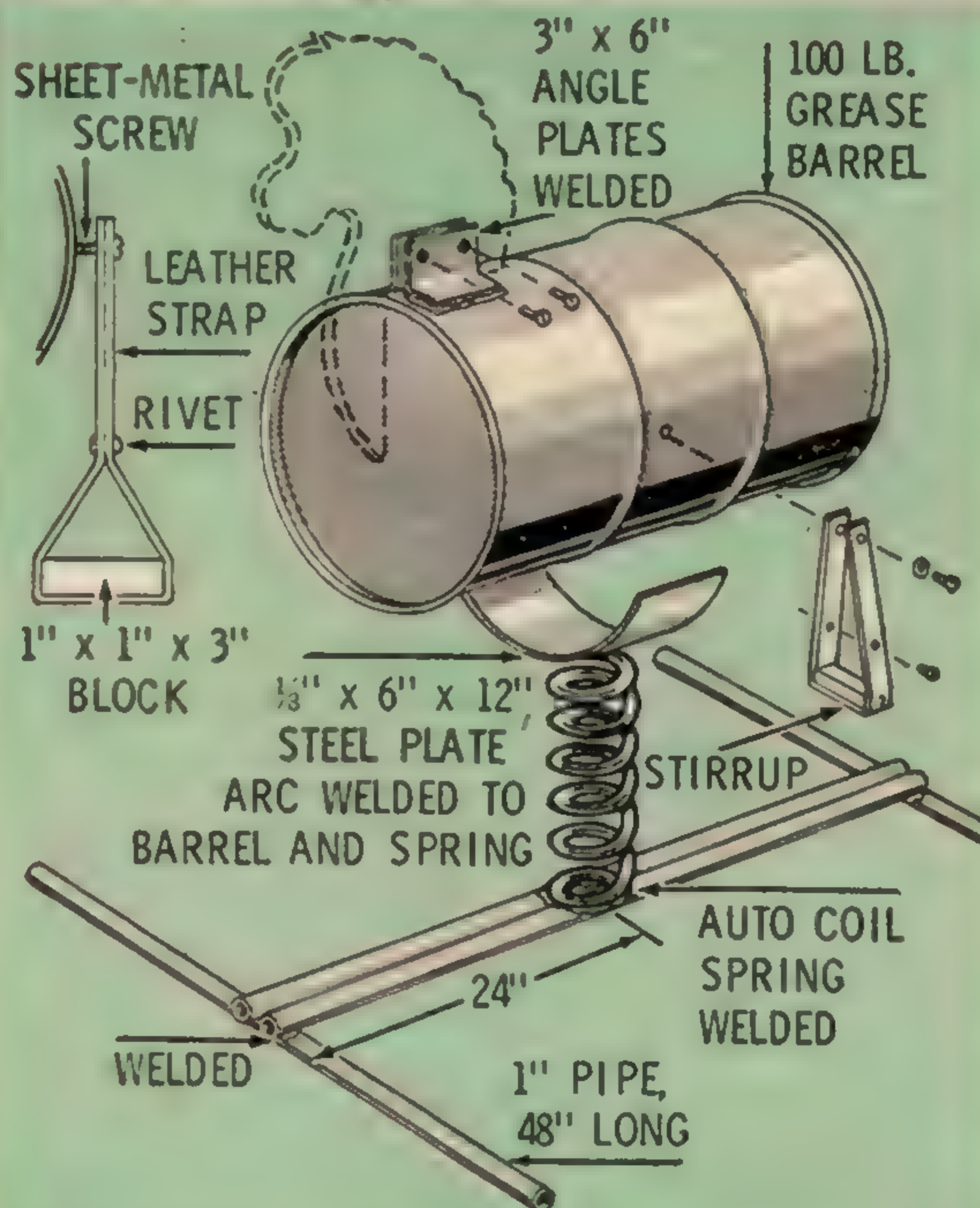
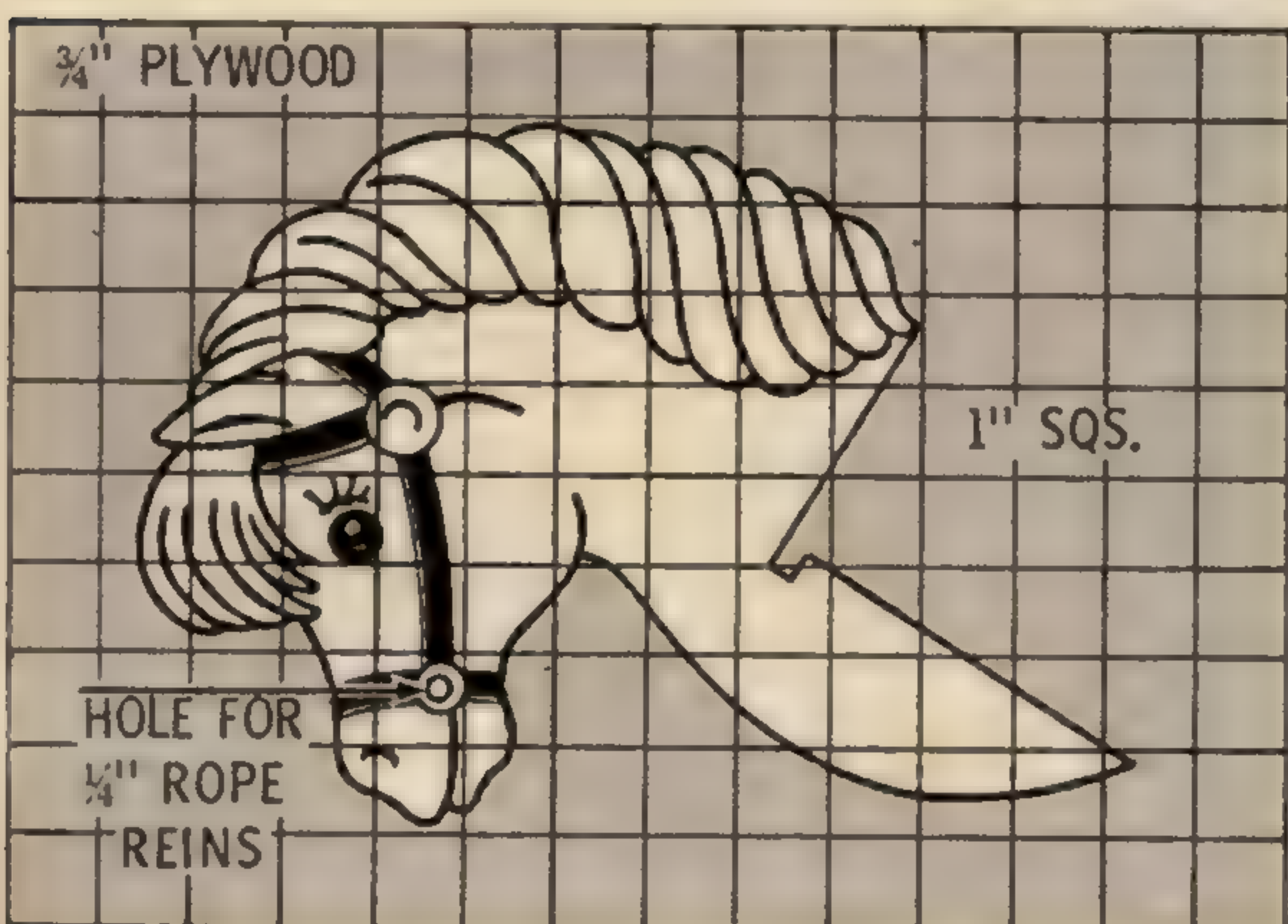
BUCKING, PITCHING and rolling, this unpredictable mount can turn any small boy's backyard into a rodeo arena. It doesn't cost much to build even if you have to have the welding done for you.

The base consists of four 48-in. lengths of 1-in. pipe welded together as shown in the drawing. An auto coil spring supports the body, which is simply a discarded grease barrel. Such barrels can usually be obtained from auto repair shops for practically nothing. Be sure to wash it out thoroughly with soap and water before you mount it on the spring, and leave it vented during welding.

Cut the head from $\frac{3}{4}$ -in. plywood, following the pattern below, then mount it on the barrel between two angle plates. Paint the whole thing before you add the stirrups and reins.

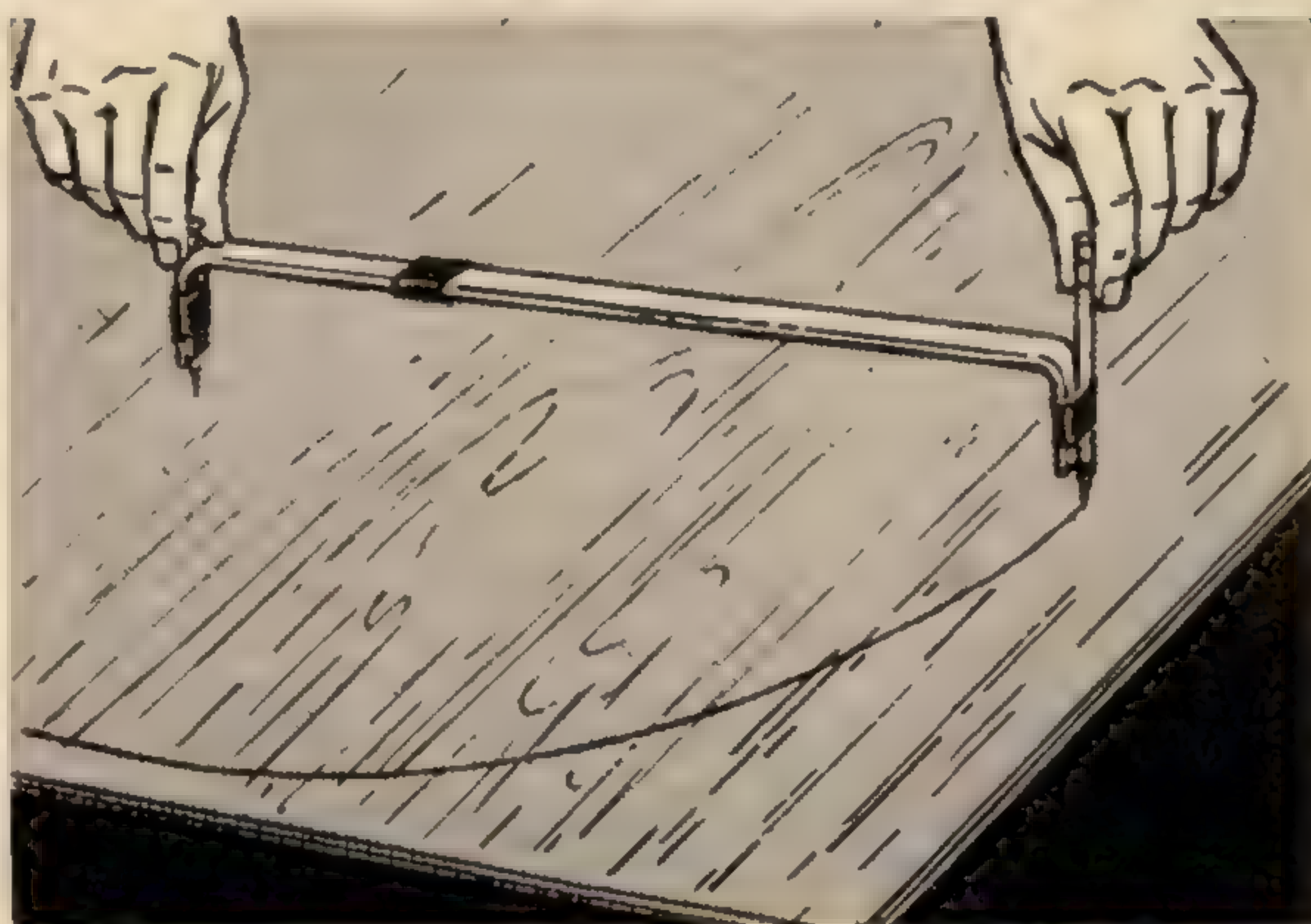
To increase stability for larger riders, you might consider burying the base about 4 in. in the ground. Another possibility is to reduce the size of the base and set it in concrete. When mounted this way, your barrel bronc will support up to 200 lbs. and make it possible to ride double.

—Richard W. Pulley

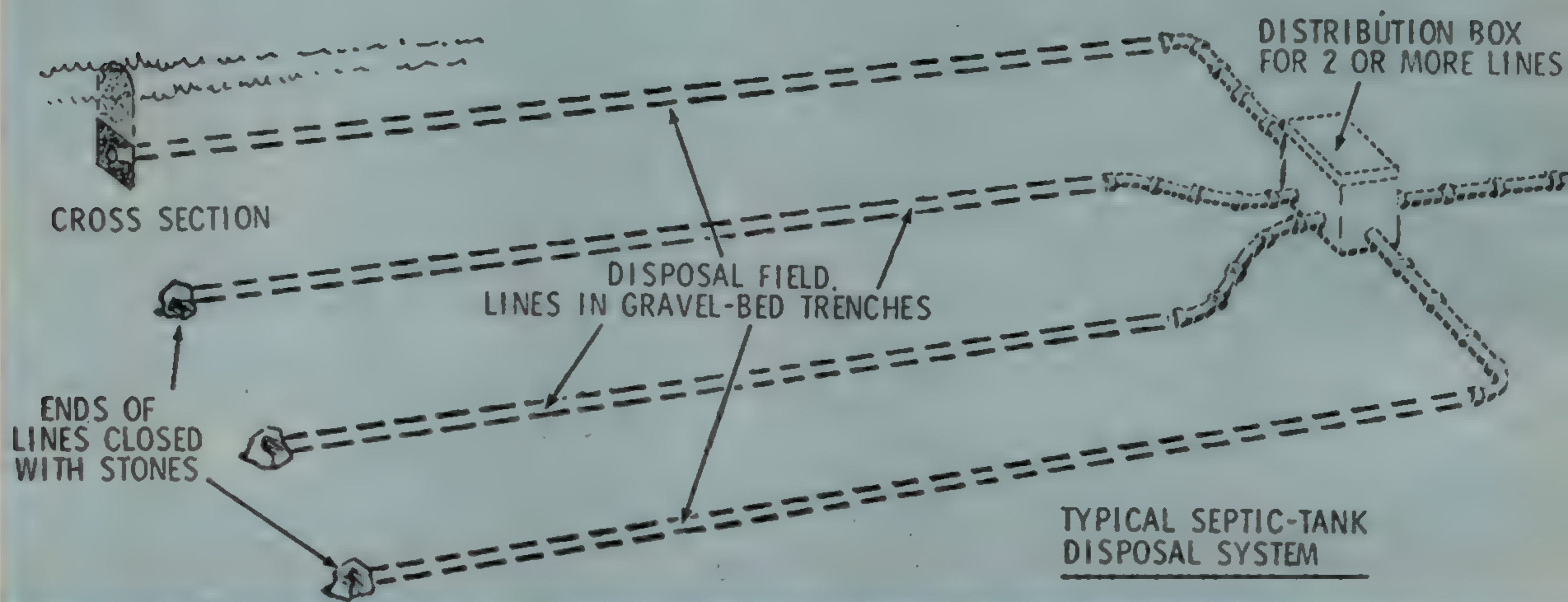


Make a Long-Reach Compass from a Curtain Rod

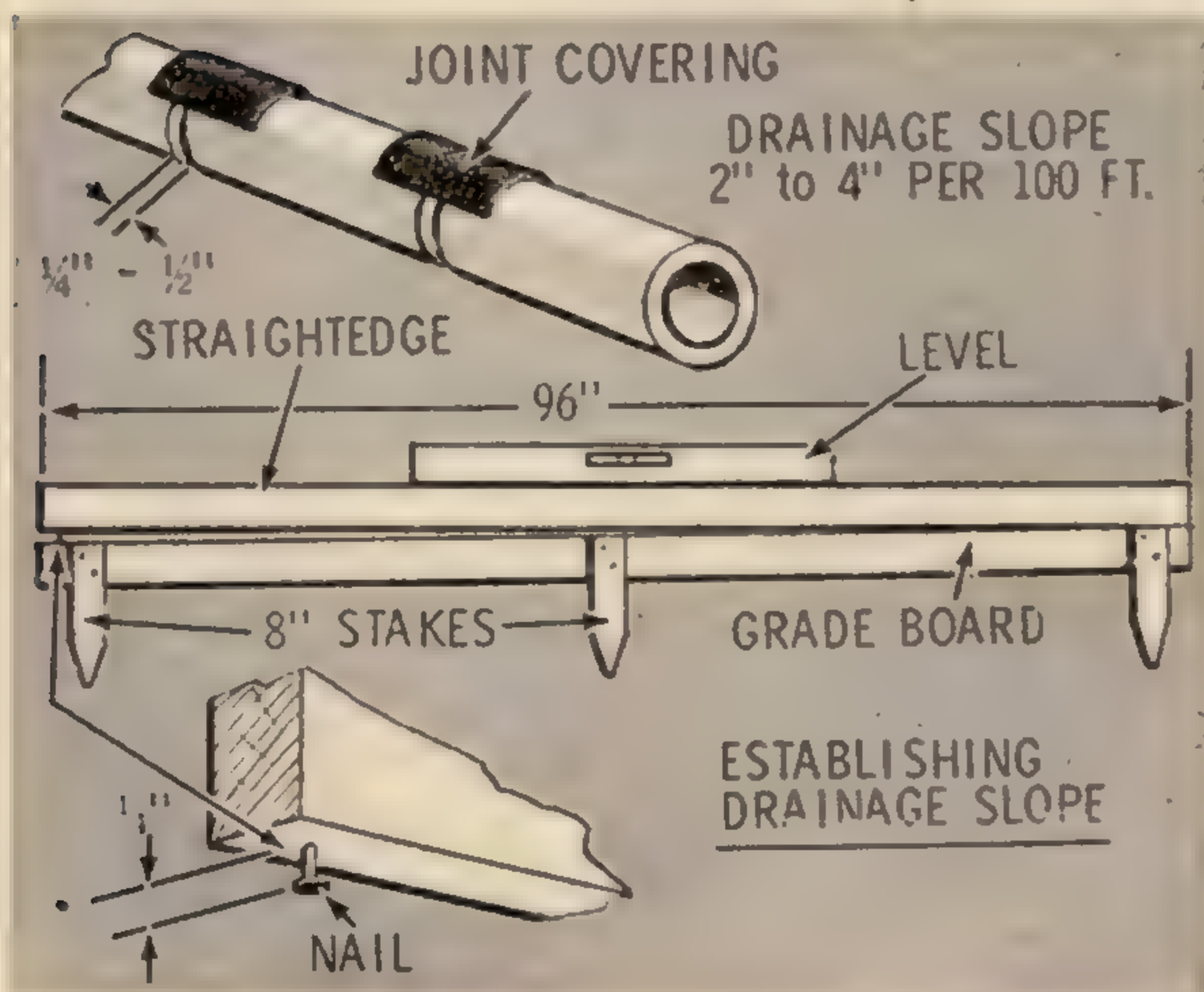
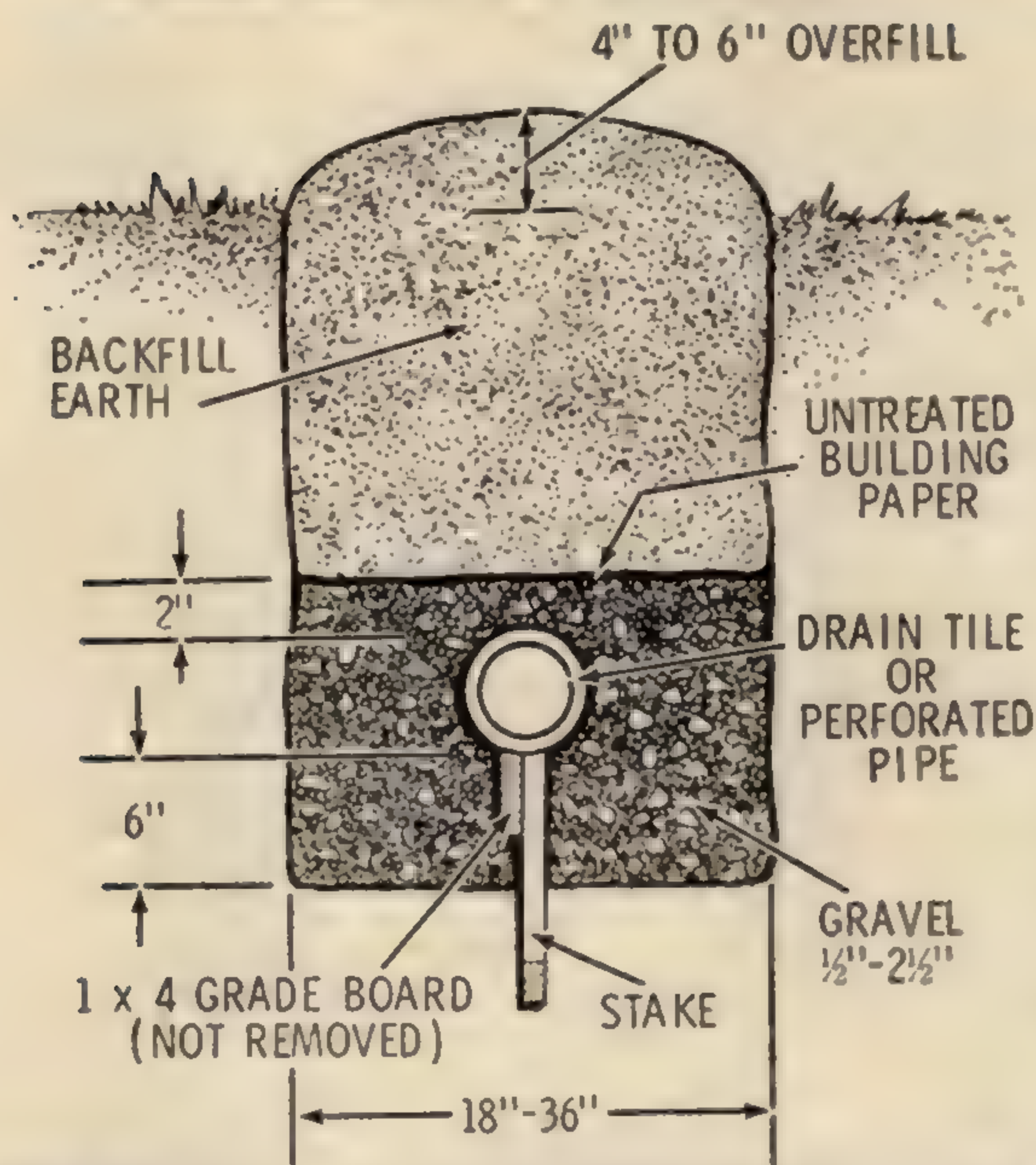
When you run into a project which requires large circles or arcs, try using an extension curtain rod as an adjustable beam compass. Tape a nail to one end of the rod to serve as a pivot and tape a sharp pencil to the other end for marking. Then extend the rod until you reach the desired measurement between the tip of the nail and the point of the pencil. Tape the joint between the two parts of the rod securely to hold this measurement and mark the circle or arc. When a circle of a different radius is required, just remove the tape and reset the measurement.—Daniel Bousha



Worry-Free Septic Systems



CROSS SECTION OF DISPOSAL LINE



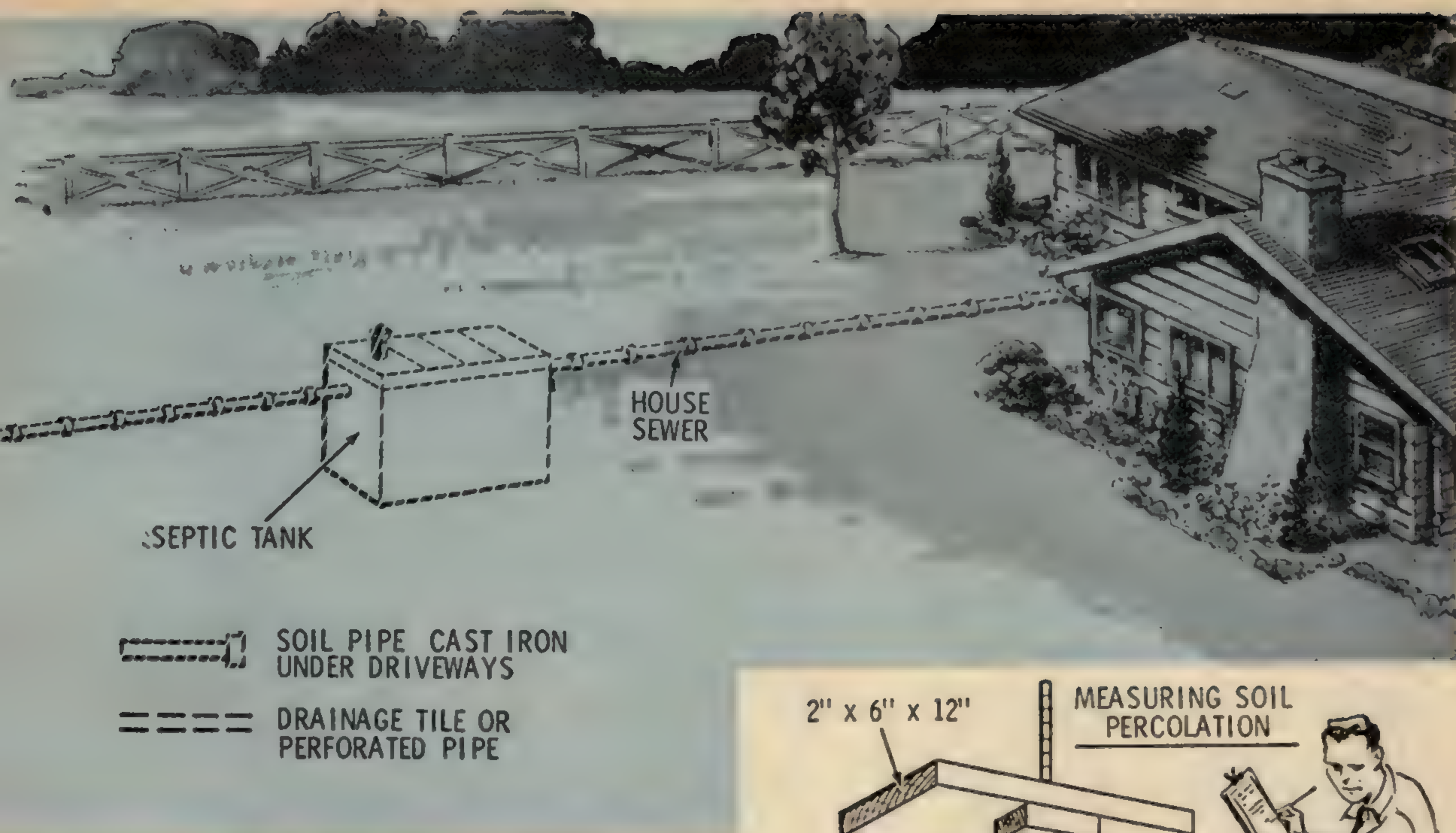
TROUBLE-FREE OPERATION of a septic-tank disposal system depends, first of all, on good design, adequate size and proper installation. Of equal importance is what (and how much) you discharge into the system, and how often the tank is inspected and emptied.

Most communities require strict compliance with local ordinances in granting a permit for a disposal system and approving its installation. Therefore, when planning one, first acquaint yourself fully with local regulations.

How system works. In a typical septic-tank disposal system, waste entering the tank decomposes in liquid that normally fills the tank up to the outlet. Part of the waste settles to the bottom forming sludge, and part of it floats on the liquid forming scum. Only the clear liquid, called "effluent," should pass through the outlet. The purpose of a septic tank is to condition the effluent for absorption in the soil. When sewage enters the tank, an equal volume of the effluent passes into the disposal lines to soak into the earth within about 36 in. from the surface. Disease-producing bacteria in the effluent are eliminated here.

Location requirements. The septic tank and disposal field must be located at safe distances from sources of water supply. In general, the distance should not be less than 50 ft. for the septic tank and 100 ft. for the disposal field. Both should be on the downhill side of the water supply source, since ground pollution moves in the same direction as ground water.

A septic tank should be at least 5 ft. from any building. The disposal field



should be located in an open area at least 10 ft. from buildings; about 15 ft. from property lines; about the same from trees and dense shrubbery (to avoid root troubles); and 25 ft. from streams or lakes.

Neither septic tank nor disposal field should be located in a swampy area or one subject to frequent flooding. The maximum height of ground water should be at least 4 ft. below ground level. Rock strata and other impervious formations should be at least 4½ ft. below disposal lines. You can check for all of this with a 2-in. earth auger fitted with extensions.

Soil porosity. When planning a septic-tank disposal system, the first thing to do is to test soil porosity. Use a 4-in. soil auger to make six or eight holes about as deep as the disposal trenches are to be, and uniformly spaced over the selected site. Scrape sides and bottoms of holes with a knife to eliminate smeared surfaces and remove loose earth. Place a 2-in. layer of gravel or coarse sand on the bottom.

Keep the holes filled with water overnight and make percolation tests 24 hours after water was first put into the holes. (The percolation rate is the time required for water to drop 1 in.) If water is still present, adjust its depth to 6 in. and measure the drop in level over 30-min. periods, using the last check to figure the percolation rate. If there is no water in the hole, fill it to a 6-in. depth and measure the drop at 30-min. intervals over a period of 4 hrs., refilling as necessary and using the last check. In soils where the first 6 in. of water seeps away in less than 30 min., measure the drop every 10 min. over a

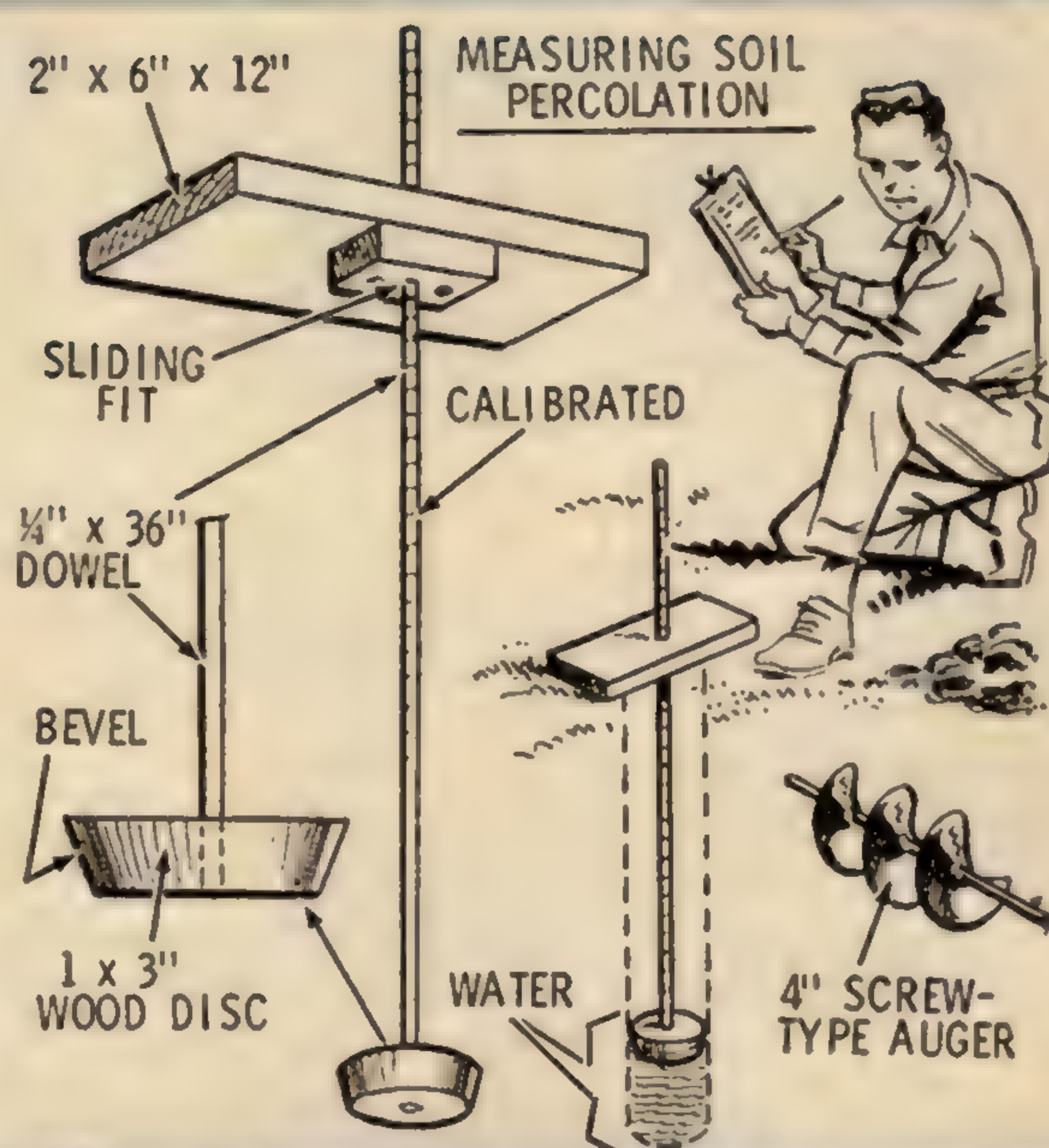


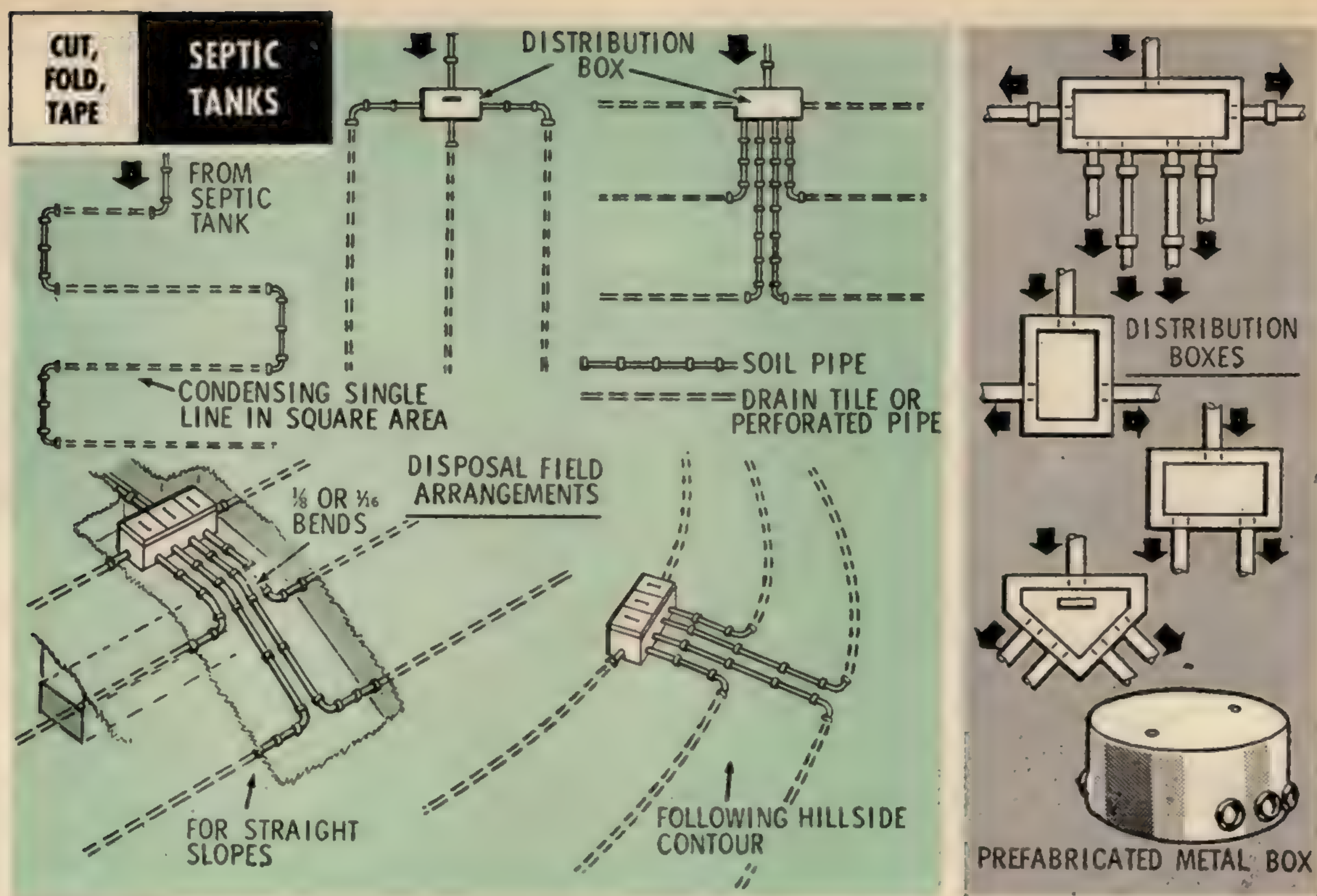
TABLE A
RECOMMENDED SIZE OF DISPOSAL-FIELD TRENCHES

PERCOLATION RATE — (MIN. WATER FALLS 1")	LINEAL FEET OF TRENCH PER BEDROOM			
	WIDTH 18" DEPTH 19"-30"	WIDTH 24" DEPTH 19"-30"	WIDTH 30" DEPTH 19"-30"	WIDTH 36" DEPTH 24"-36"
2 OR LESS	57	43	34	28
3	67	50	40	33
4	77	58	46	38
5	84	63	50	42
10	110	83		55
15	127	95	76	63
30	167	125	100	83
60	220	165	132	110

OVER 60—NOT SUITABLE FOR DISPOSAL TRENCHES.
NOTE—MINIMUM TRENCH LENGTH IS FOR 2 BEDROOMS.

TABLE B
DISTANCE BETWEEN TRENCHES

TRENCH WIDTH	FEET DISTANCE TWEEN CENTERLINES
12" TO 18"	6'
18" TO 24"	6½'
24" TO 30"	7'
30" TO 36"	7½'



period of an hour and use the last check. Refer to Table A for the needed length of the disposal field per bedroom in the dwelling it is to serve. If the soil has a percolation rate slower than 1 in. in 60 min., it is not suitable for a disposal field. In such cases the local health authority should be consulted for recommendations.

Disposal field. Most disposal fields consist of trenches in which drain tile or perforated, non-metallic pipe is laid in gravel. Only this type of disposal area will be discussed here. Trenches should not be less than 18 in. nor more than 36 in. in either depth or width. The depth is influenced by septic-tank outlet and ground slope.

A single line should not exceed 100 ft. in length. Parallel lines should be spaced as in Table B. If there are two or more lines, a distribution box is needed to control the flow uniformly. It may be prefabricated or cast in concrete on the site. The outlets are at equal level just above the bottom. The cover should be removable, sealed and at least 8 in. below ground level. The pipe line from the septic tank to the distribution box, and also those from the distribution box to the separate disposal lines should be soil pipe with leakproof joints. A gravel bed under this pipe is unnecessary but the pipe should have the same drainage slope as the disposal lines.

After the trenches are dug, 1x4 grade boards on which pointed stakes are nailed are located centrally in the trenches. The

upper edge should be about 6 in. above the trench bottom and should have a drainage slope of $\frac{1}{4}$ in. per eight lineal feet. The bottoms of the trenches are raked to a depth of 1 in. to eliminate smeared and compacted earth which interferes with absorption. Gravel or crushed stone ($\frac{1}{2}$ in. to $2\frac{1}{2}$ -in.) is laid on the bottom up to the top edge of the grade boards, which remain in place.

Next, 4-in. drain tile, or perforated pipe with holes down, is placed centrally on the boards while more gravel is added on either side and on top, enough to cover the pipe to a depth of at least 2 in. Joints between drainage tile should be open from $\frac{1}{4}$ in. to $\frac{1}{2}$ in., and the top of each joint is covered with a piece of asphalt-impregnated paper or a sheet-metal cover. After the gravel is smoothed, it is covered with untreated building paper, or with a 2-in. layer of straw or hay. When refilling the trench, pile up a mound of earth 4 in. to 6 in. high to allow for settling, so no depression will form along the trench line.

For sloping grades the disposal lines are laid at right angles to the direction of the slope if it is straight. Otherwise, the lines follow the ground contour. A driveway should not be laid over any portion of the disposal field. Drainage tile may be crushed by the weight of heavy vehicles. If the disposal field is on one side of a driveway and the septic tank on the other, the two should be connected with cast-iron pipe.

Septic tank: This may be a prefabri-

cated steel tank suitably coated to prevent rusting; a prefabricated concrete tank having reinforced walls not less than 2½ in. thick; a concrete tank, cast on the site, having 6-in. reinforced walls and bottom; or a tank made of concrete blocks. The inside surfaces of the latter two should have a ¼-in.-thick coating of 1:2 portland cement-sand plaster, or other effective waterproofing.

Table C gives the required capacities of septic tanks based on the number of bedrooms. (The capacity of a tank is the volume below the liquid level.) These capacities allow for the disposal from garbage grinders, automatic washers and other common household appliances. It is best to have a tank that exceeds requirements, however, as fewer cleanings then will be necessary, which reduces maintenance cost.

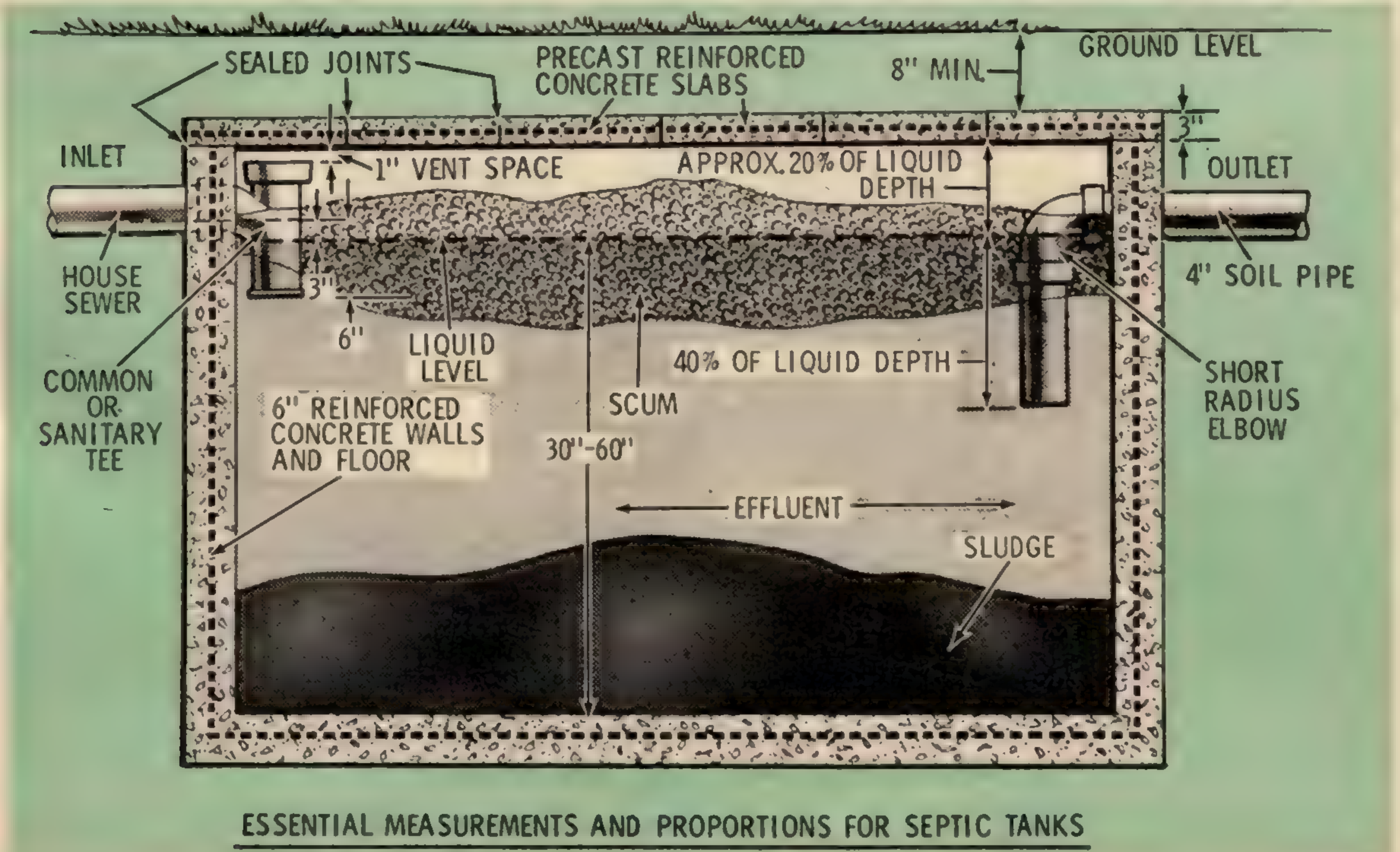
A septic tank must be watertight. Cover slabs of 3-in. reinforced concrete are sealed with asphalt mastic or cement mortar to prevent the entrance of water or escape of gas. No vent is needed on the tank as the soil-pipe stack of the house serves this purpose.

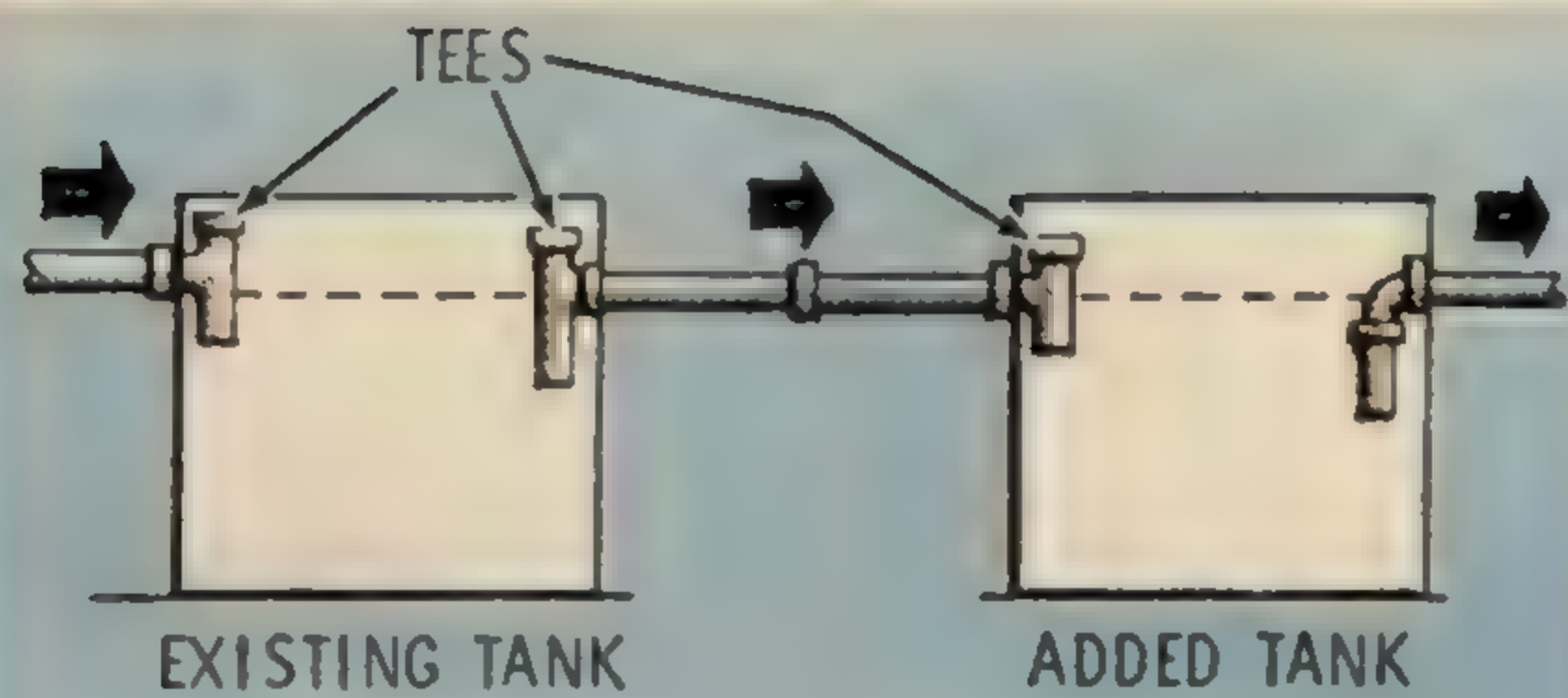
The shape of a septic tank, whether square, rectangular or cylindrical, is of little importance. The top of the closed tank should come at least 8 in. below ground level. The outlet is provided with a tee, elbow or baffle extending below the liquid surface a distance of about 40 percent of its depth, for tanks having vertical sides, and about 35 percent for cylindrical tanks installed horizontally. For the for-



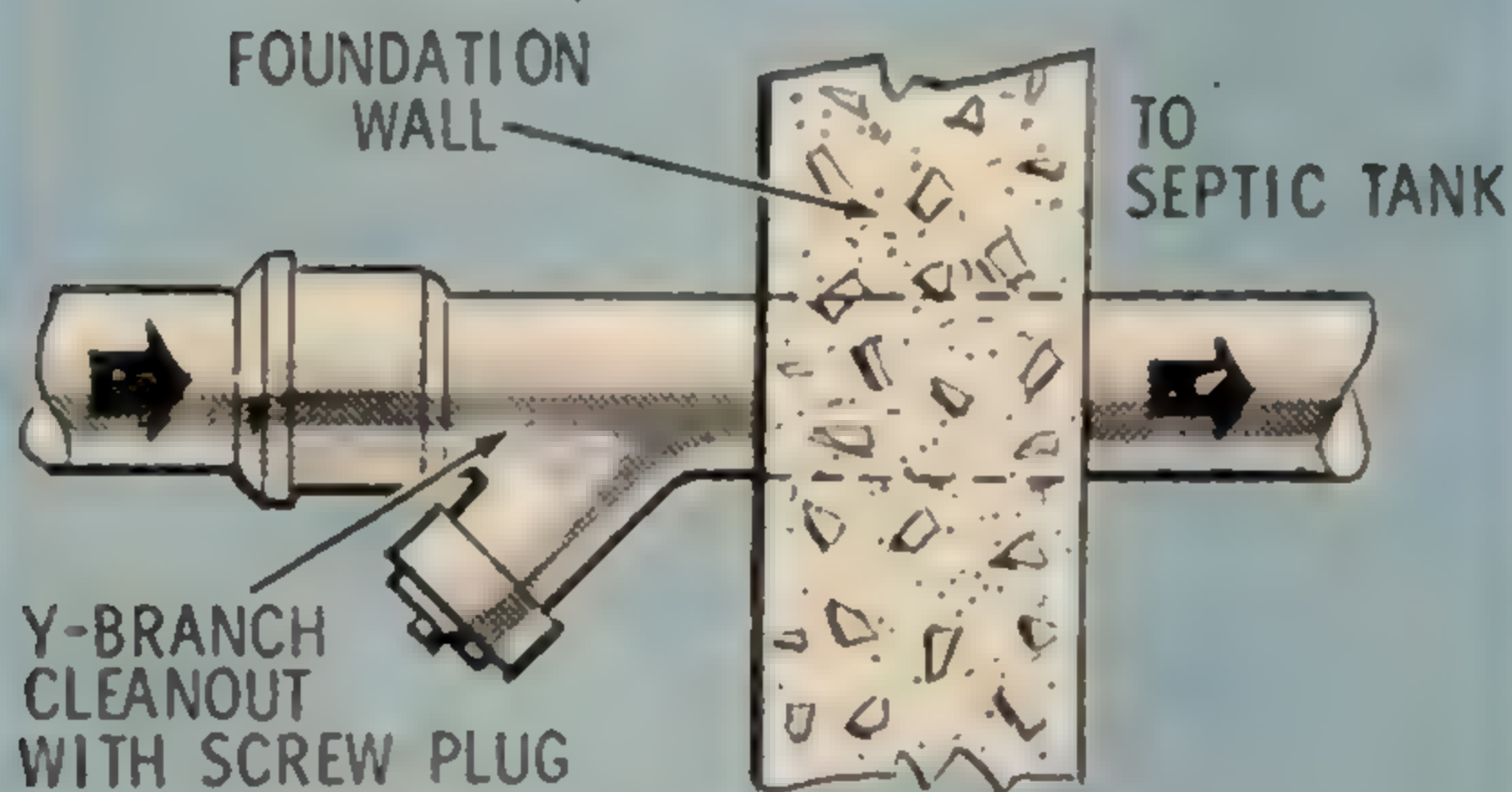
WHEN SEPTIC TANK is cast on the site, the walls and bottom should be at least 6 in. thick and reinforced. Also, the inner surfaces must be waterproofed

TABLE C RECOMMENDED SIZE FOR SEPTIC TANKS					
INCLUDES ALLOWANCE FOR GARBAGE GRINDER, AUTOMATIC WASHERS AND OTHER APPLIANCES					
NUMBER OF BEDROOMS	MINIMUM CAPACITY (GALS.)	RECTANGULAR TANK SIZE (FT.)			
		WIDTH INSIDE	LENGTH INSIDE	DEPTH INSIDE	LIQUID DEPTH
2 OR LESS	750	3½	7½	5	4
3	900	3½	8	5½	4½
4	1,000	4	8	5½	4½
5	1,250	4	9	5½	4½
1 CU. FT. VOLUME EQUALS 7.48 GALS.)					

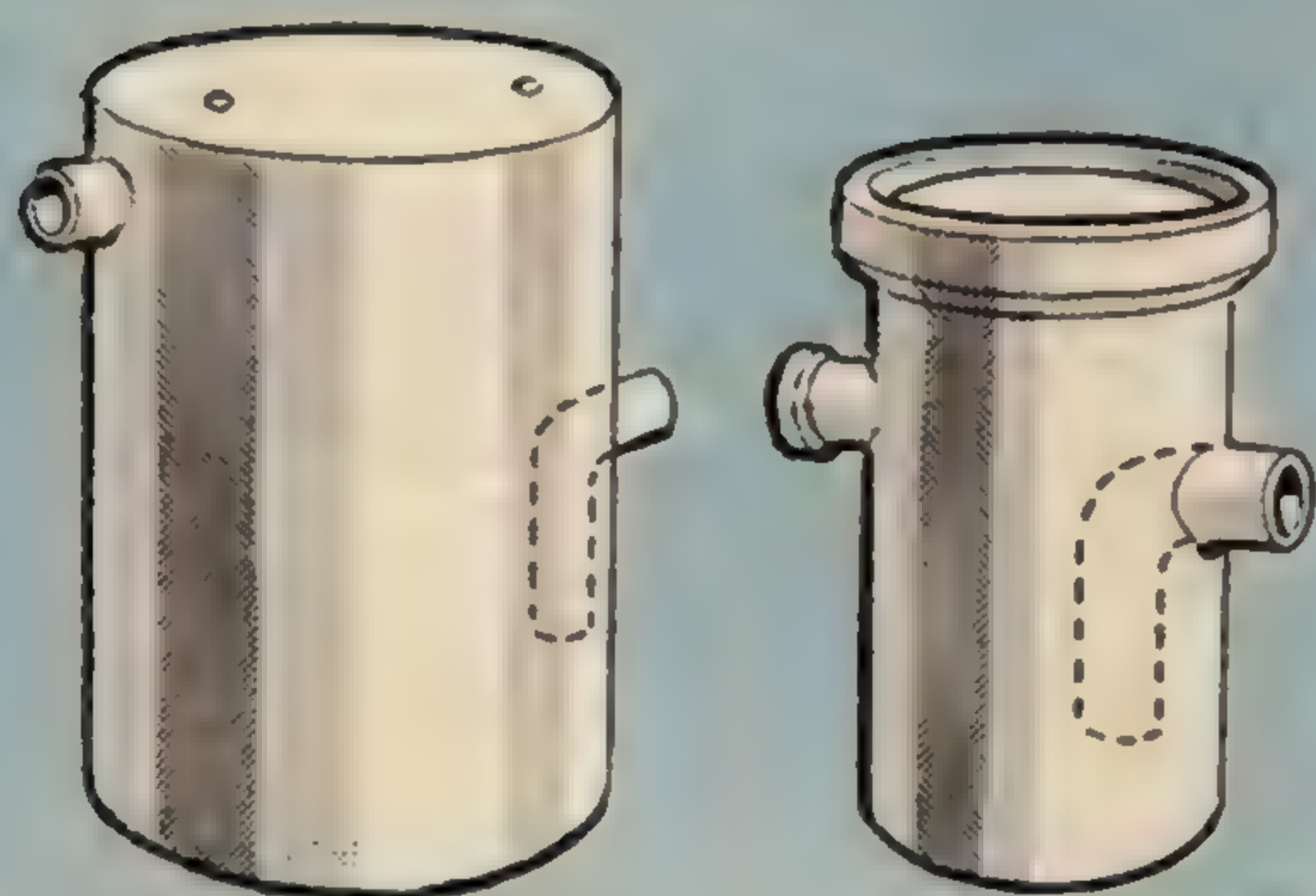




INCREASING CAPACITY OF SEPTIC TANK

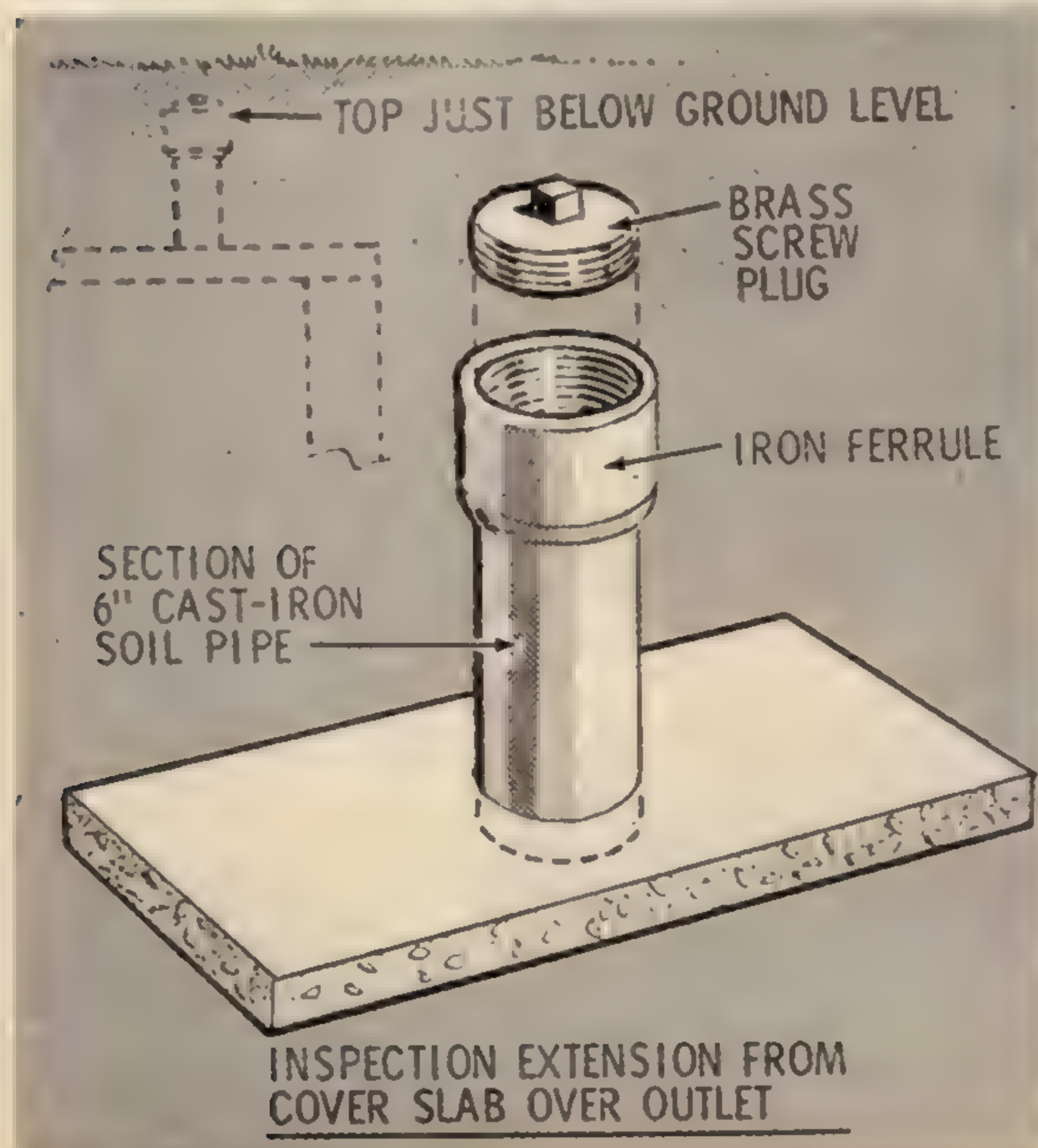


CLEANOUT FOR HOUSE SEWER



STEEL WITH RUST-INHIBITIVE COATING VITRIFIED CLAY
PREFABRICATED GREASE TRAPS
(VARIOUS SIZES AVAILABLE)

INSPECTION EXTENSION installed in cover slab provides easy access to check sludge and scum levels



mer, the distance from inside top to liquid surface should be about 20 percent of the liquid depth, and for the latter this distance should be about 15 percent. The inlet should be at least 1 in. above the liquid surface, and preferably 3 in. A tee or baffle is provided to extend about 6 in. below the liquid surface to assure minimum disturbance from entering sewage. The upper end of the tee or baffle should be about 1 in. below the tank top to permit gas in the tank to escape through the house stack.

A single-compartment tank will give entirely satisfactory results, although a two-compartment tank (or two tanks connected) will be slightly more efficient. If a disposal system becomes too small to meet increased requirements, a second tank can be added and the size of the disposal field increased. The depth of the house sewer is determined after a septic tank has been installed. This pipe should have a cleanout opening at the house.

Maintenance: When first put into operation a septic tank does not require an additive such as yeast to start fermentation, although this may accelerate it. Septic-tank systems in constant use seldom freeze. Where winter temperatures are exceptionally low, protection can be provided with an adequate layer of straw, hay or snow. When the system is out of service for a period of time it is more susceptible to freezing. Clogging of disposal lines by roots occurs mostly in lines not having enough gravel under them. Usually the roots concentrate in the gravel.

Soaps, detergents, bleaches, drain cleaners, disinfectants, fat, oil, grease, the discharge of a garbage grinder and of other common household appliances connected to the plumbing system—none of these will, in normal amounts, have any adverse effects on septic-tank disposal systems of the sizes given in the tables. Waste brines from water softeners also are not harmful in a septic tank, but they may shorten the life of the disposal field.

Chemicals not normally used in homes may cause trouble, so it is unwise to risk their disposal in a septic-tank system. These include chemicals used for photography or other hobbies and workshop activities. Substances not likely to decompose easily in a septic tank (toilet-paper substitutes, paper towels, newspapers, rags, etc.) should be disposed of elsewhere. Another thing to avoid is the introduction of large volumes of water, such as the drainage from roofs.

Where an excess of oil, fat and grease is anticipated, it is best to provide a grease trap. The grease is skimmed off the surface frequently so that only clear fluid will pass

TABLE D ALLOWABLE SLUDGE ACCUMULATION			
LIQUID CAPACITY OF TANK (GALLONS)	LIQUID DEPTH(Feet)		
	3	4	5
	Distance from bottom of outlet to top of sludge (inches)		
500	11	16	21
600	8	13	18
750	6	10	13
900	4	7	10
1,000	4	6	8

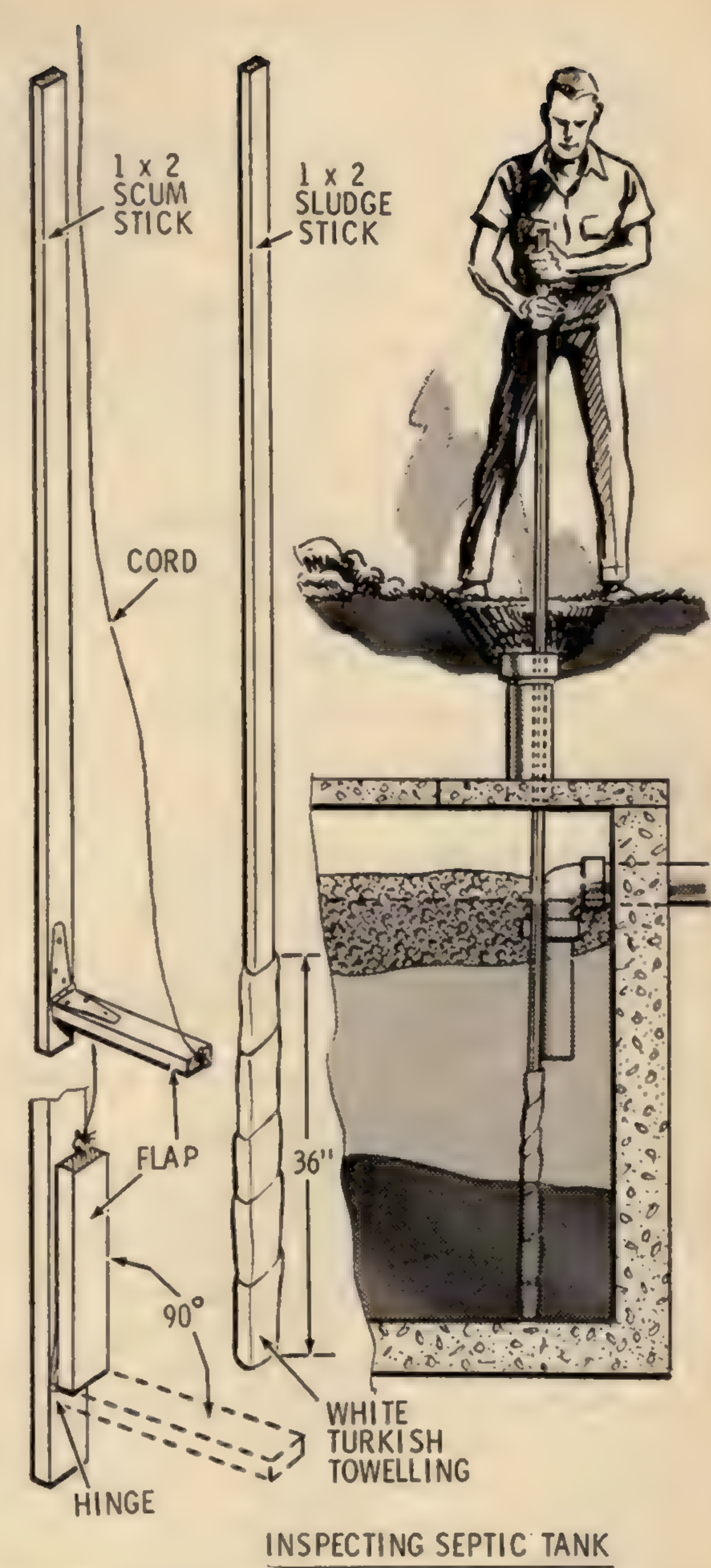
into the septic tank. With such an installation the discharge of a garbage grinder must not be passed into the grease trap but directly to the septic tank.

Many products, some containing enzymes, are being sold for the purpose of improving operation of septic tanks and to prevent or cure troubles. As far as is known, none of these products has proved of value in properly controlled tests, according to the U.S. Dept. of Health, Education and Welfare. Drain and septic-tank cleaners containing sodium hydroxide or potassium hydroxide should not be used too frequently nor in excessive amounts. (The above findings do not apply to chemicals designed to maintain soil porosity in disposal fields.)

The predominant reasons for trouble in septic-tank disposal systems are: (1) Lack of consideration for the percolation rate of the soil when installing a system; (2) Level of ground water too high; (3) Overloading the system with substances and chemicals that interfere with fermentation or reduce the absorptive quality of the soil in the disposal field; (4) Failure to empty a septic tank when necessary, which allows solids to pass into the disposal field and clog it. When soil porosity of the disposal field is reduced for any of the above reasons the effluent can rise to the ground surface which causes an offensive odor and creates a definite health hazard which must be corrected.

To remedy the condition when you have a disposal field of adequate size, and one that originally had sufficient percolation rate, the soil porosity must be restored or a new disposal field provided. The first can be done easily and economically by introducing emulsifiable chlorobenzine (available under trade name of Cloroben) into the septic tank and on the ground surface of the disposal field where it also helps to eliminate the offensive odor which is always present.

Inspection and cleaning: Although constant fermentation decomposes much of the scum and sludge in a septic tank, inert



WITH TWO STICKS you can measure accumulation of sludge to determine when tank needs cleaning



solids gradually accumulate to the point when the tank must be emptied. This varies considerably according to load. Some tanks will require cleaning within three years. Others may not require cleaning for much longer periods. To be sure that solids in the tank will not pass into the disposal field and clog it, an annual inspection is recommended. This can be done by a septic-tank cleaning concern. For homeowners who prefer doing this themselves, much unnecessary work can be avoided by providing an inspection outlet on the cover slab over the tank outlet. After uncovering this, allow gas in the tank to disperse by ventilation before inspection.

Safety Precautions

Avoid breathing the gas or igniting a match near it since the gas is both asphyxiating and explosive. Use a stick with a hinged flap to force it through the scum layer near the outlet. Let the flap drop to a horizontal position and then pull the stick up until you feel resistance of the scum layer. Then mark the stick at the top of the inspection outlet. Next, lower it again and pull it up against the lower end

of the outlet elbow, tee or baffle, again marking the stick. The difference between the marks is the distance of scum to the outlet.

To measure the sludge thickness, wrap the end of a stick with rough, white toweling and tack it in place. Insert this through the hole previously made in the scum, and push the stick to the tank bottom, turning it as you would an auger. After a few minutes pull it up slowly so some sludge will remain on the toweling and so indicate the sludge thickness.

The tank should be emptied when the lower surface of the scum is about 3 in. above the bottom of the outlet, and so soon as the sludge comes within the limits given in Table D. Usually, tank cleaning is done by means of a tank truck equipped with a pump. An emptied tank should not be washed or disinfected; some of the sludge should be left to resume fermentation.

When installing a septic-tank system a diagram showing the location and measurements should be placed in a suitable and permanent location inside the house, for future reference in the event the property changes hands. ★ ★ ★

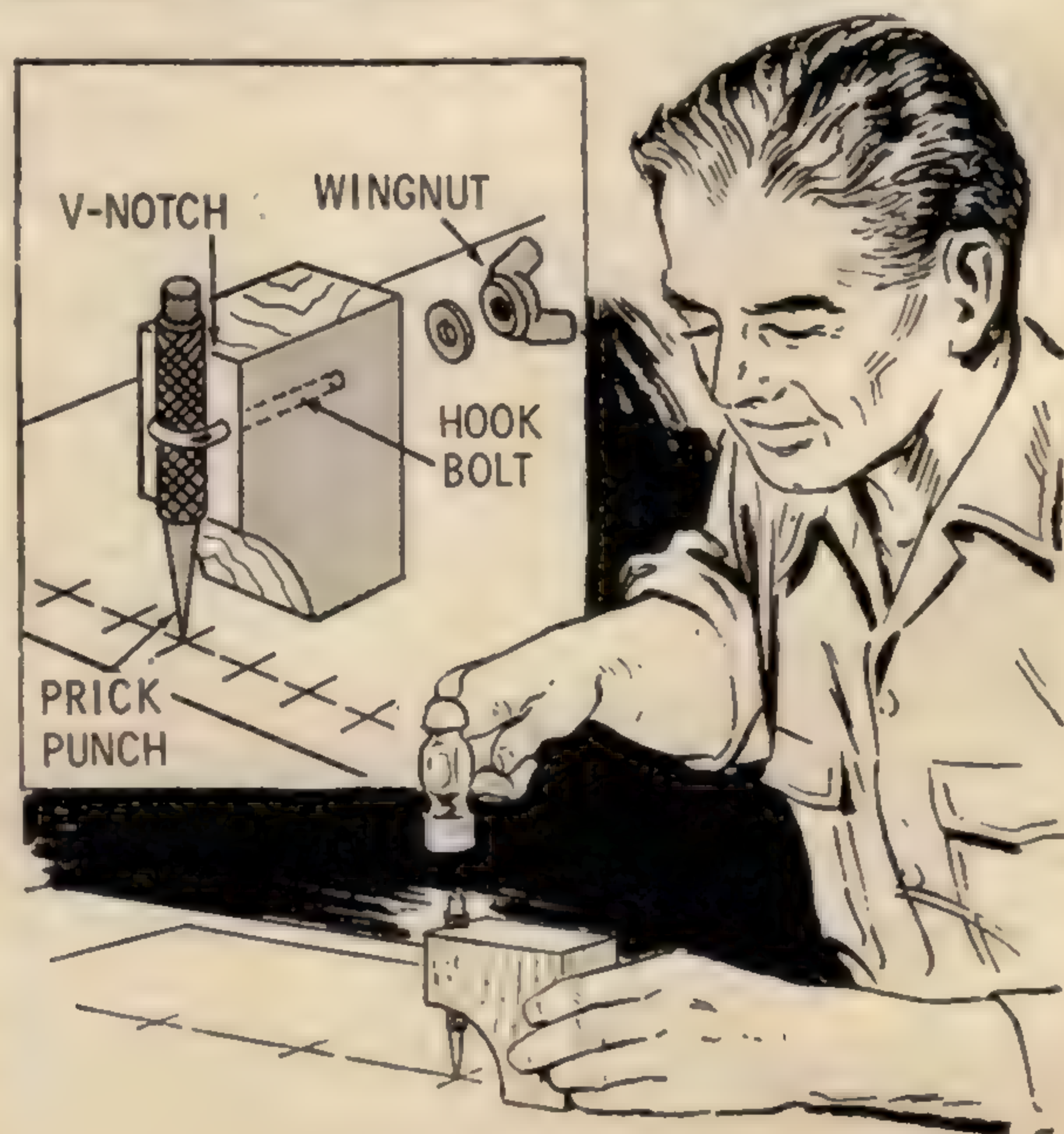
Pull-up Draft Deflector

One way of deflecting the draft from an opened window is to mount a roller shade below the sill. Just cut a dowel a couple of inches longer than the width of the shade and slip it through the hem in place of the slat so that it projects on either side. The projecting dowel ends can then be inserted in screws eyes driven into the casing, thus supporting the shade.—G. E. Hendrickson



Perpendicular Punch Holder

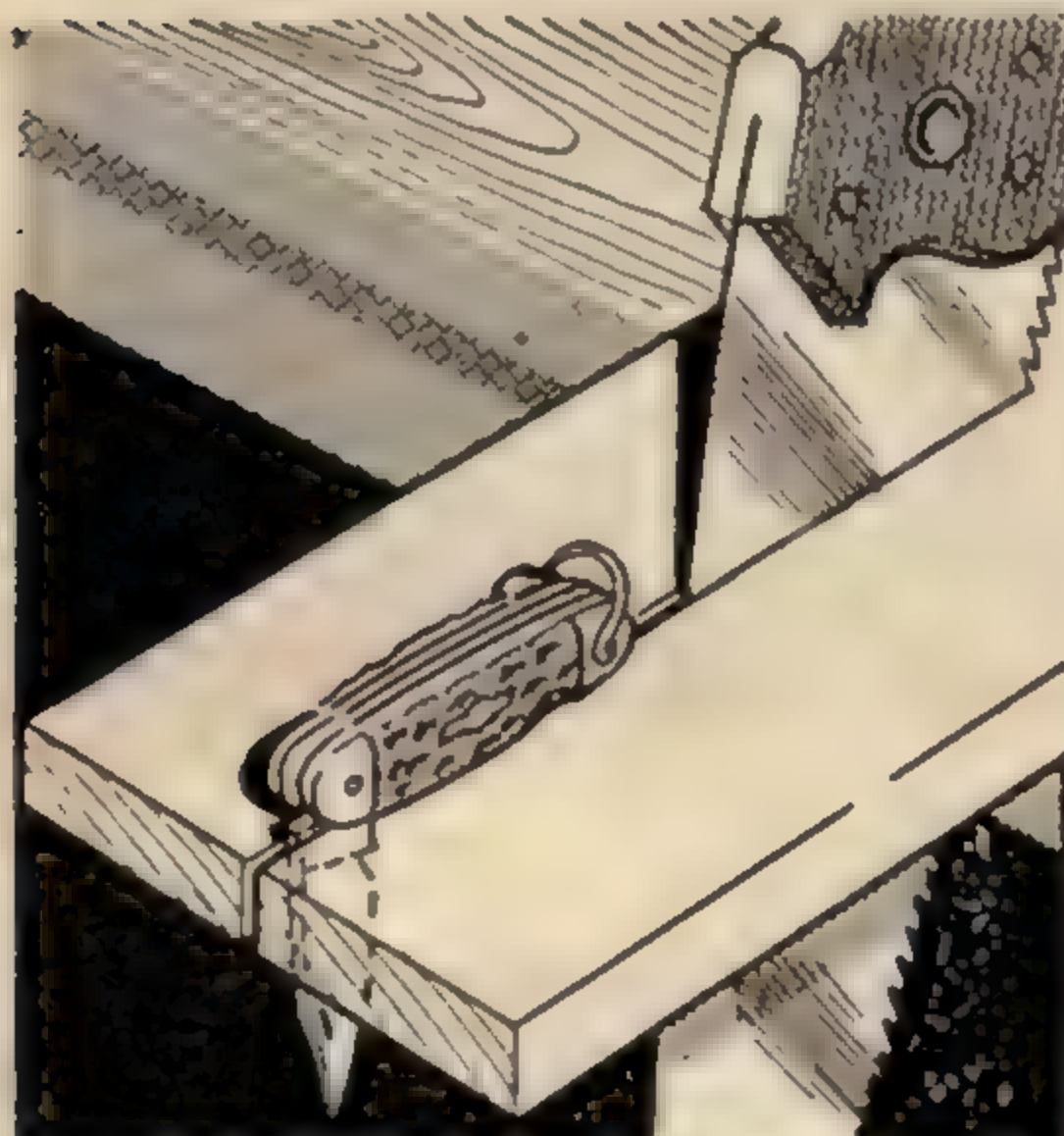
The chief cause of inaccuracy when making punch marks in sheet metal is holding the punch out of perpendicular, which causes a slight drift. If you make up a notched block, as shown below, and drill it for a bolt hook, the punch can be clamped in a perpendicular position. However, it's absolutely essential that the notch be cut accurately at right angles to the bottom of the block.—Enno R. Haan



TAKE A HINT FROM READERS

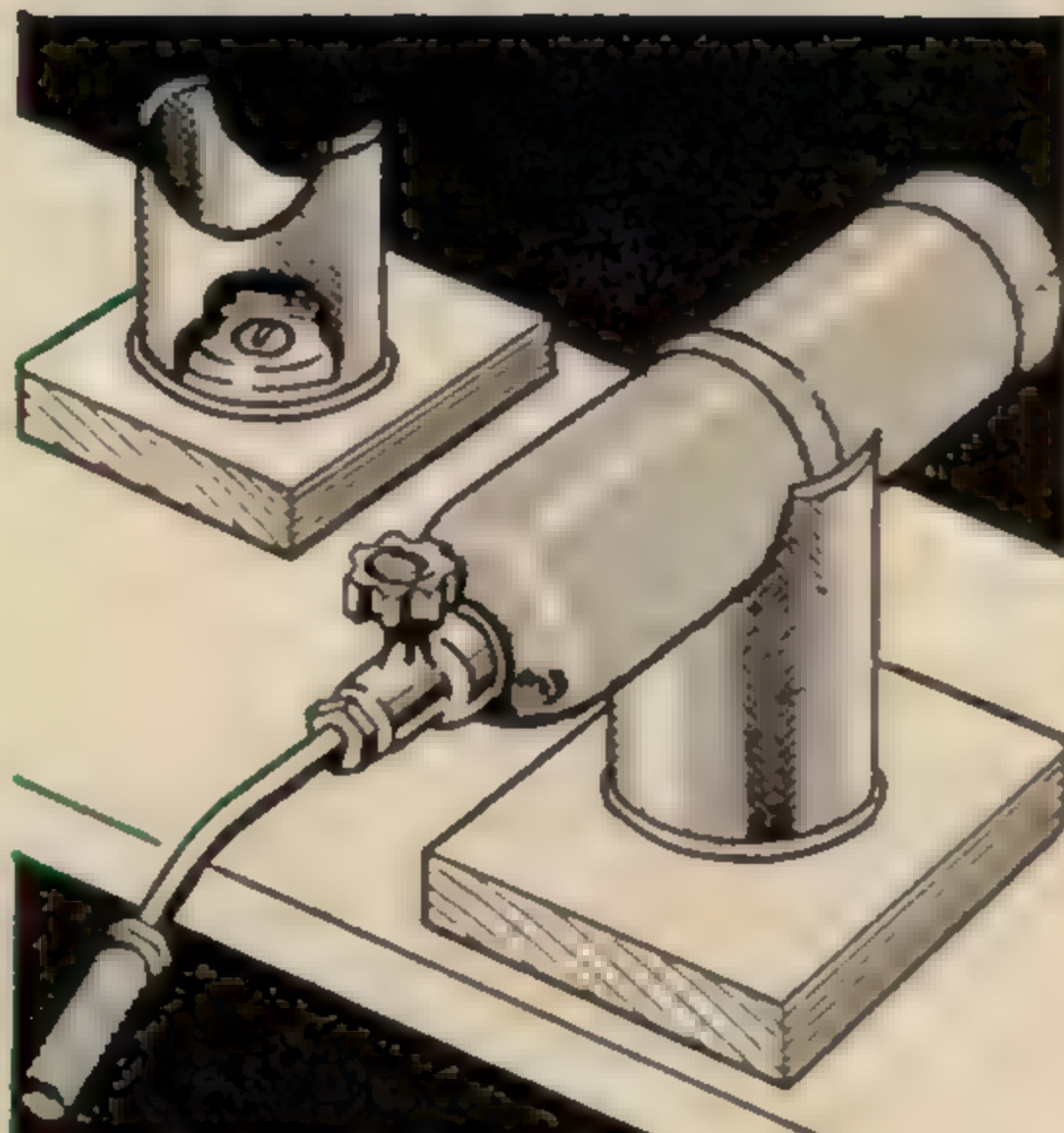


TEMPORARY brush keeper to protect bristles between coats is made by cutting a slit in the plastic lid of a coffee can and inserting handle through it so bristles are suspended in solvent



JACKKNIFE with the large blade half opened does fine job as sliding wedge to hold the kerf open when ripping long boards. Body of knife rests on top—can't drop through like plain wedge

TO MAKE row markers for garden, open seed packets from bottom so they will be right side up when slipped over a marker stake. Protect from weather by inverting glass jar over stake

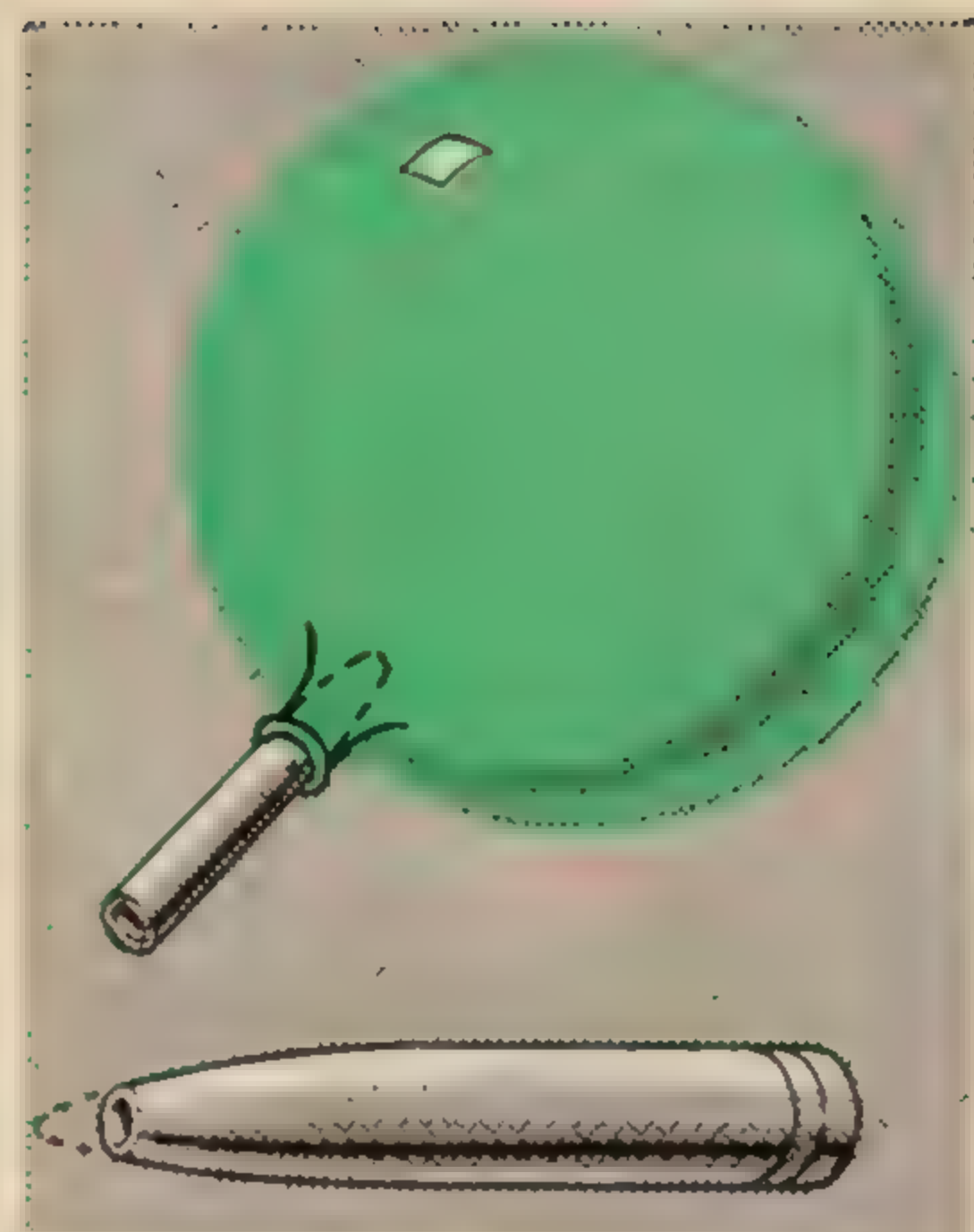
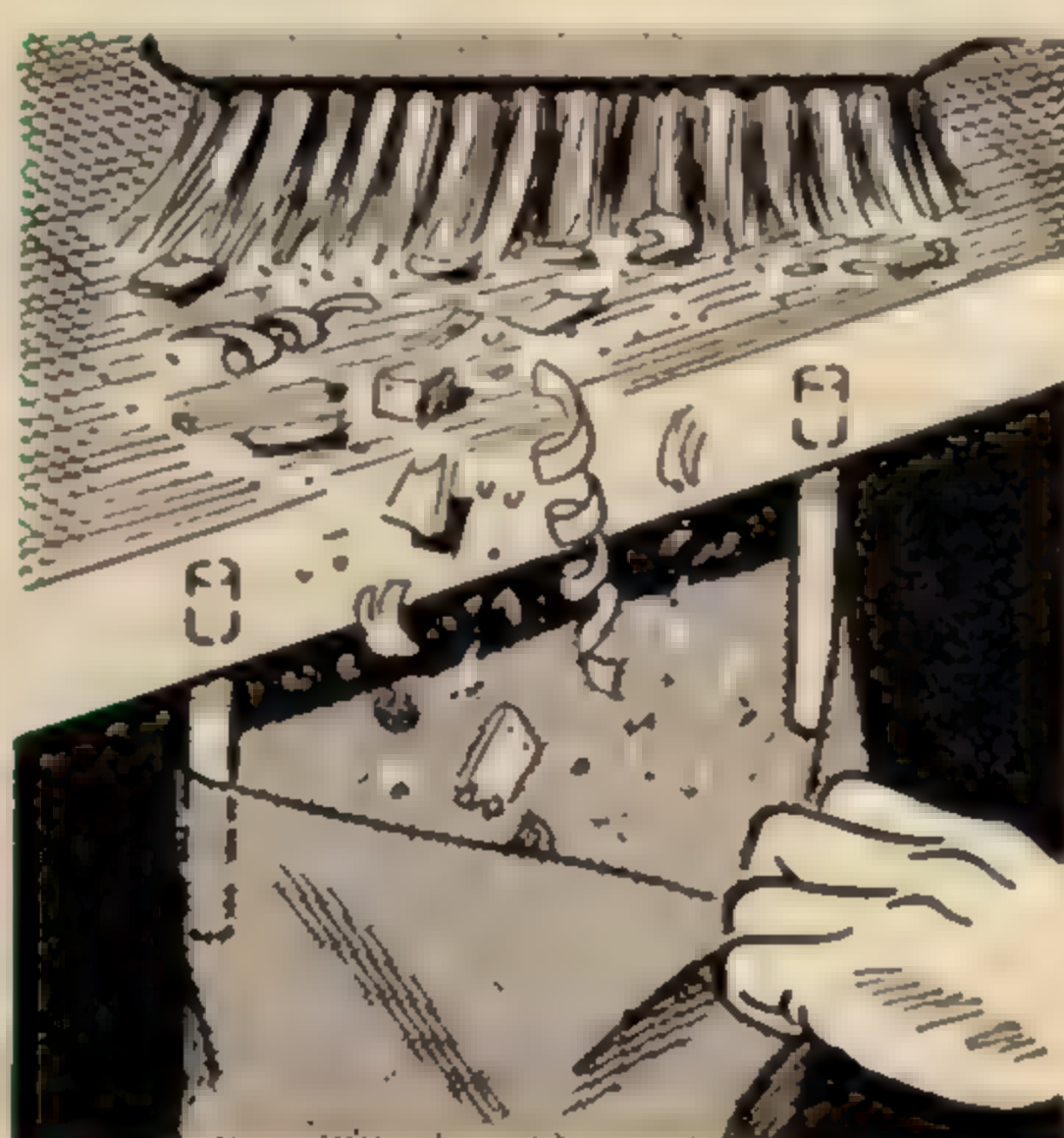


TIP-PROOF holder for propane torch is just a tin can cut as shown and mounted on a 6-in.-sq. wood base. Lighted torch may be stood upright in can or cradled in the curved cutout

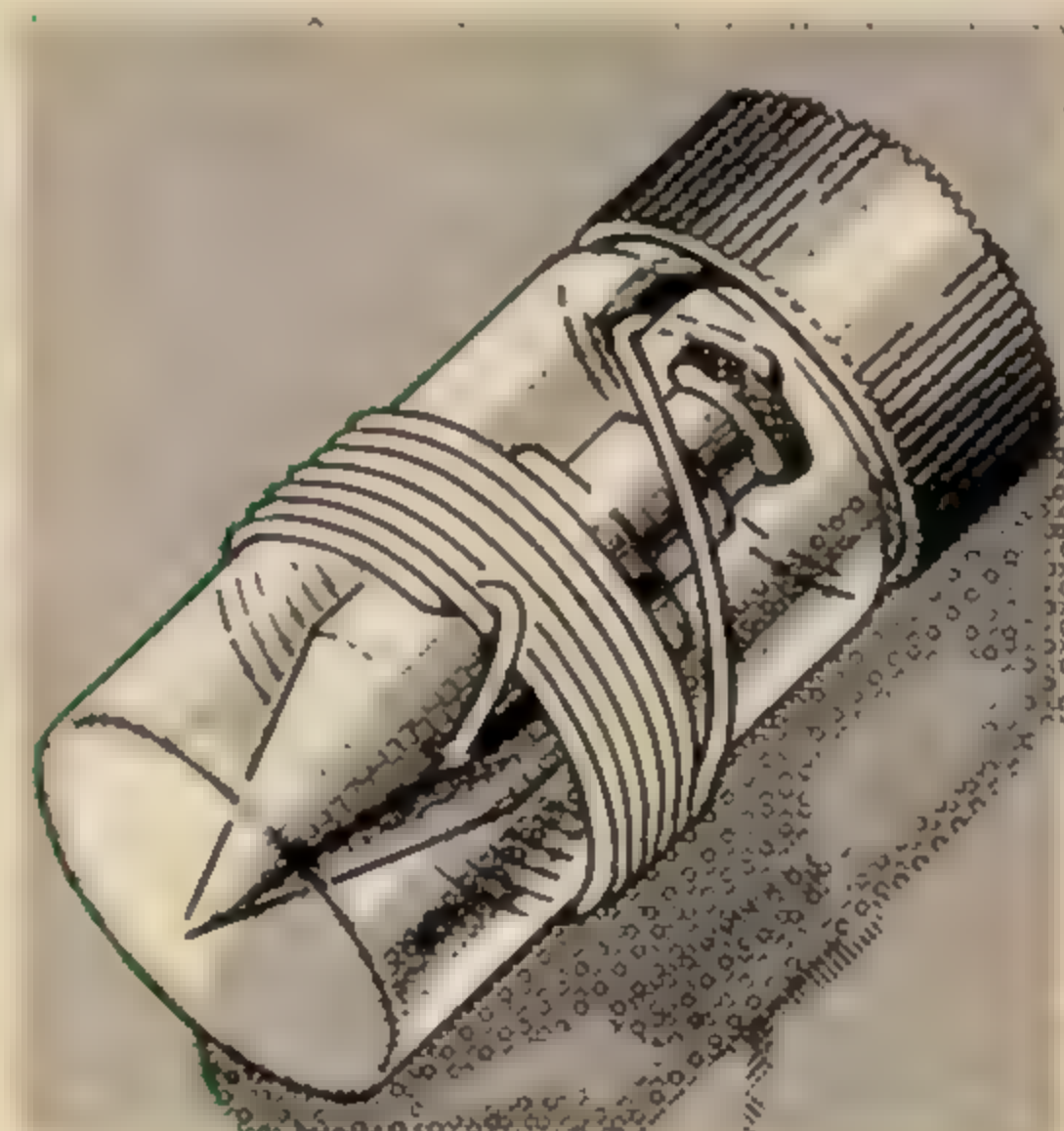


NO DANGER of spilling an open bottle of soldering acid on your workbench if you pull the end of a large roll of friction tape around it as shown. The tape roll acts as a broad base

DRIVE a couple of dowel pegs into holes drilled in the underside of your workbench near the edge and you'll have fingers to hold paper bags open when sweeping the bench top

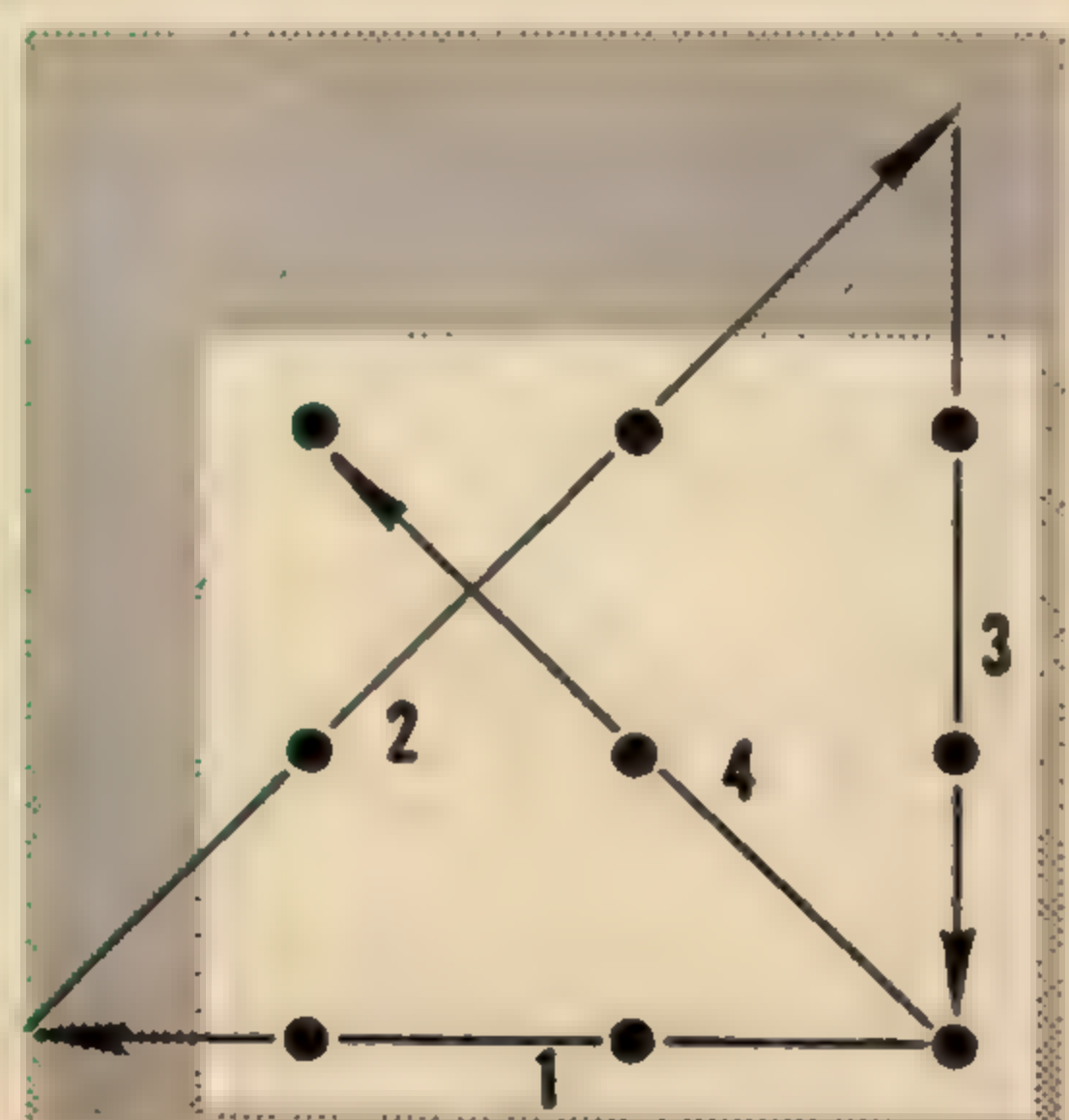


MOUTHPIECE makes it easier to hold neck of balloon while blowing it up. Cut the tip off the barrel of an old pen and slip this tapered end into neck, then blow through other end



POCKET CASE for a small plumb bob and line can be made by notching the rim of a plastic pill bottle, placing bob inside, running line out notch and wrapping it around bottle

ANSWER to the brain teaser on page 141 is given in the diagram below. Most people try to reach a solution within the bounds of the dot pattern. It's a good one to try on friends



To Lube Or Not To Lube

SATURDAY MECHANIC

Part II

By Morton J. Schultz

TO DISCUSS the chassis-lube phase of the program outlined in last month's installment of this article, it's necessary to review the long intervals now recommended between chassis lube jobs. Before 1960, most car manufacturers merely said, "grease 'em every 1000 miles, or at least every 2000." Since then, however, the picture has changed radically.

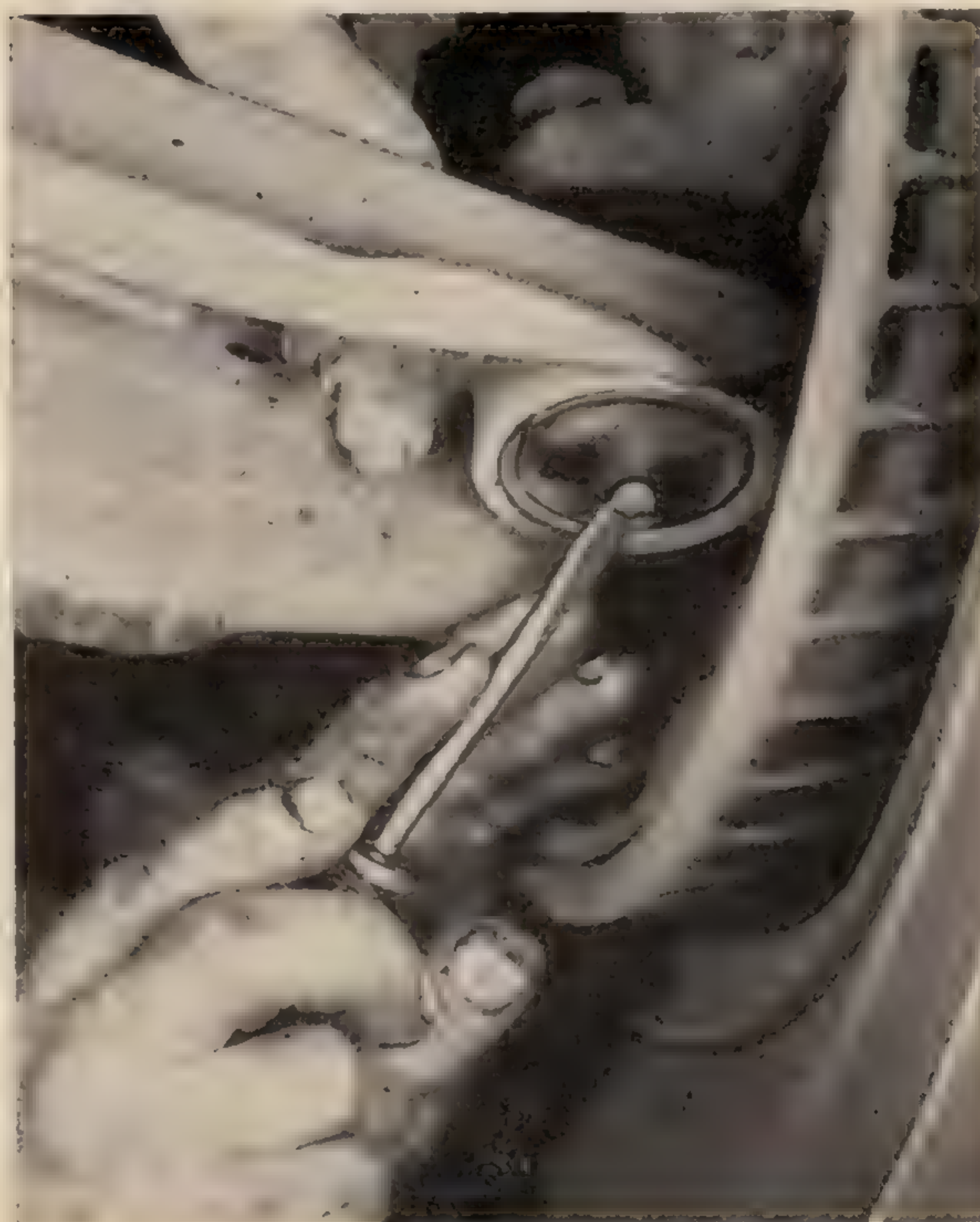
For example, of 21 different cars marketed in 1964 and 1965, 14 of them differ as to time recommendations between grease jobs. With such divergence, is it any wonder that some motorists feel Detroit is simply playing with numbers.

Now, to clarify the situation, let's examine a couple of the facts that lie behind the long-interval claims:

Fact 1—Since the early 1960's, the design of such parts as ball joints, steering linkages and grease fittings, has improved. This design improvement has been accompanied by improvement in lubricants. So, it is conceivable that, under certain conditions, you can drive a car for as long as

LUBRICATING

FIRST, remove seal. In this Caddy, it's a rubber plug. Other models have screw-on or plastic plugs



the manufacturer states without greasing.

However, the extent of these developments is a debatable point—not only in the public's mind, but apparently among auto manufacturers themselves. The center of the debate seems to be the so-called sealed or prepacked joint.

In those lines where prepacked parts are used—specifically Cadillac, the Chrysler-built products, Ford, Mercury, Lincoln and Rambler—a really long period between grease jobs is suggested. The Chrysler and Rambler people recommend 32,000 miles or three years. In the Ford line (including Mercury and Lincoln), the suggestion is 36,000 miles or three years. However, Ford's Thunderbird is given a 100,000-mile, or a three-year, send-off. Finally, Cadillac goes the limit by stating that you don't have to lubricate unless something's amiss.

On the other side of the picture is the General Motors line, exclusive of Caddy. Chevrolet, which doesn't use prepacked parts, says to grease every 6000 miles or six months. Pontiac doesn't use sealed fittings either, but extends its recommendation to 30,000 miles or 12 months. Naturally, it's more likely that you'll hit 12 months before 30,000 miles.

Buick and Oldsmobile are stranger breeds. They use prepacked parts in some areas and regular lubrication fittings in

others. For the prepacked, the companies claim that no lubing is necessary until something goes wrong. For regular grease fittings, however, they recommend greasing once every 6000 miles or six months.

In most cases, as you'll see, there's some reservation. These involve variations for different models, such as Tempest and F-85, and the type of grease that's used.

Obviously, there are still differences of opinion, with the final outcome of the prepacked joint controversy still uncertain.

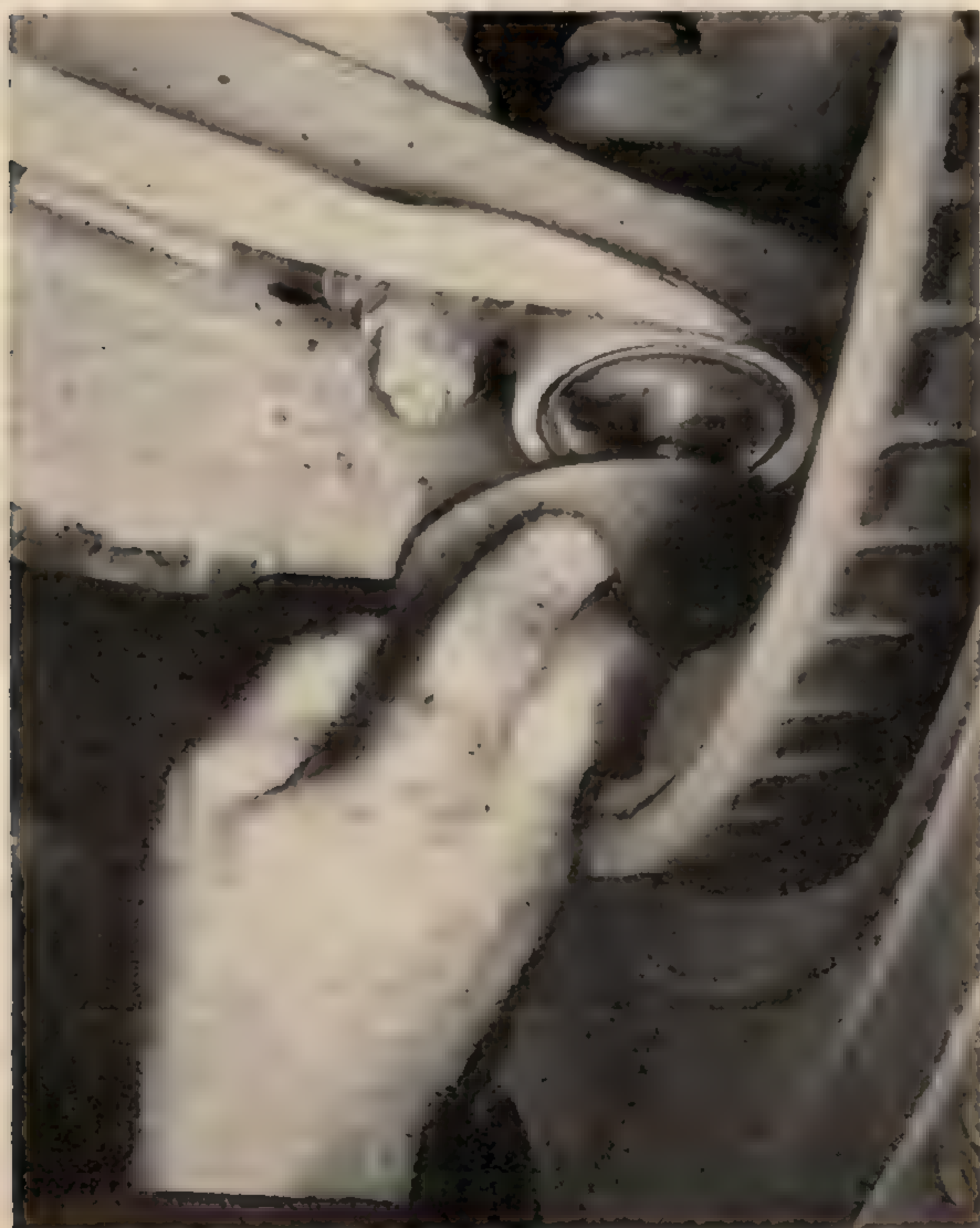
Fact 2—Although no one does much talking about this fact, it is known in the automotive industry that recommended chassis lube intervals should really be treated as *guides only*. They aren't intended to be gospel.

For example, it's well known that under rough conditions, such as driving in dusty areas or where there's lots of rain and snow, a car will seldom approach the recommended lube interval without needing grease. If a car begins to squeak, the man who insists on waiting for the interval recommendation is playing a dangerous game that's frowned on by the auto makers who established the interval.

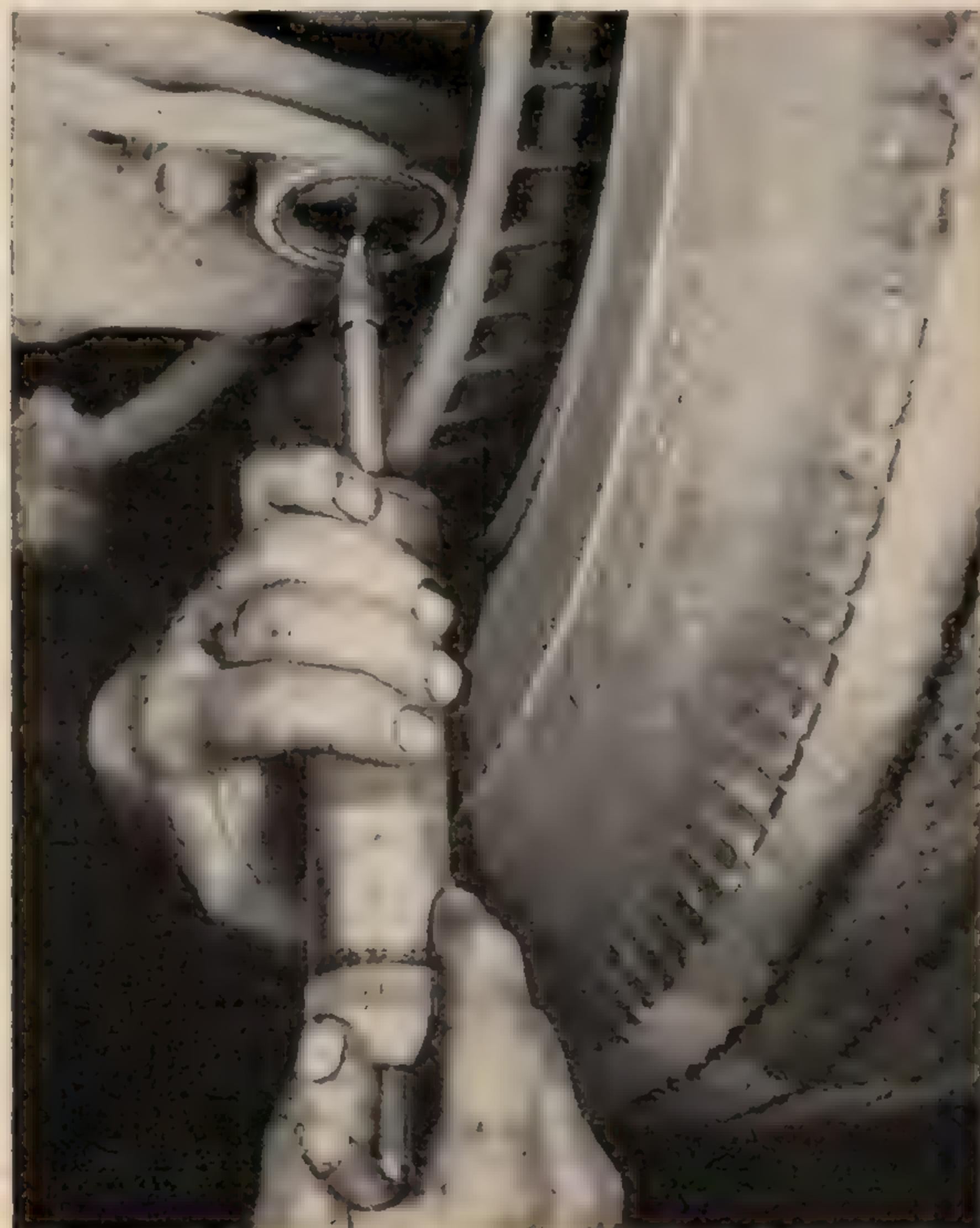
Ever since the advent of extended lubrication intervals, some in industries allied to autos—specifically, fuels and lubricants—have recommended a periodic under-the-car inspection. There are two reasons

SEALED JOINTS

THEN, be sure to wipe all dirt away from the lubrication hole, to avoid contamination of the new lube



FINALLY, shoot in the lubricant from a low-pressure hand gun, to avoid rupturing seal, then re-plug hole



WHEN, WHERE AND HOW TO DO A CHASSIS LUBE

Car	Year & Model	Lube Interval	Fittings	Grease to Use	Special Instructions
Buick	1961-62	Every 1000 miles	Regular	Chassis lube	
Buick	1963-65 (all models except 1964-65 Skylark and Special)	Every 6000 miles or 6 months or as needed	Regular and sealed	Buick Spec. #742 or chassis lube	If chassis lube is used, grease every 2000 miles. Sealed fittings need not be greased until area begins to squeak unless it's been serviced with regular chassis lube
Buick	1964-65 Special and Skylark	Every 6000 miles or 6 months	Regular	Buick #742 or chassis lube	If regular chassis lube is used, grease every 2000 miles
Cadillac	1961-62	Inspect every 4000 miles	Sealed	Caddy No. 1474829 on suspension; No. 1474830 on steering linkage	Inspect only. Replace any lubed parts that are losing grease; lube any squeaking parts
Cadillac	1963-65	Inspect every 60 days or 6000 miles	Sealed	Caddy No. 1474829	Same as above
Chevrolet	1961-62	Every 1000 miles	Regular	Chassis lube	
Chevrolet	1963-65	Every 6000 miles or 6 months	Regular	Chassis lube, water resistant EP type	
Chrysler	1961 (all models)	Every 2000 miles	Regular	Chassis lube	
Chrysler	1962 (all models)	Inspect every 4000 miles; grease every 32,000 miles	Sealed	MoPar No. 2525035	
Chrysler	1963-65	Inspect every 6 months; grease every 32,000 miles	Sealed	MoPar No. 2525035	
Dodge	1961-65	Same as respective year Chrysler			
Ford	1961-62 Falcon	Every 1000 miles or 30 days	Regular	Chassis lube	
Ford	1961-62 (all models except Falcon and T-Bird)	Every 30,000 miles or 2 years	Sealed	Ford Spec. ESA-M-1C47A or ESA-M-1C75A	
Ford	1961 T-Bird	Every 4000 miles or 4 months	Regular	Same as above	
Ford	1962 T-Bird	Every 6000 miles or 6 months	Regular	Same as above	
Ford	1963-65 (all models except T-Bird)	Every 36,000 miles or 3 years	Sealed	Same as above	
Ford	1963-65 T-Bird	Every 6000 miles or 6 months and every 100,000 miles or 3 years	Sealed	Ford Spec. ESA-M-1C47A or ESA-M-1C75A	Inspect steering linkage every 6000 miles or 6 months. If damaged or loose, replace entire pivot assembly. Lubricate front suspension every 100,000 miles or 3 years
CUT, FOLD, TAPE AUTO LUBE					
Imperial	1962-65 (all models)	Same as respective year Chrysler			
Lincoln Continental	1961-63	Every 30,000 miles or 2 years	Sealed	Ford Spec. ESA-M-1C47A or ESA-M-1C75A	
Lincoln Continental	1964-65	Every 36,000 miles or 3 years	Sealed	Ford Spec. ESA-M-1C47A or ESA-M-1C75A	
Mercury	1961-62 Comet	Every 1000 miles or 30 days	Regular	Chassis lube	

Car	Year & Model	Lube Interval	Fittings	Grease to Use	Special Instructions
Mercury	1961-62 (all models except Comet)	Every 30,000 miles or 2 years	Sealed	Ford Spec. ESA-M-1C47A or ESA-M-1C75A	
Mercury	1963-65 (all models except Comet)	Every 36,000 miles or 3 years	Sealed	Ford Spec. ESA-M-1C47A or ESA-M-1C75A	
Mercury	1963-65 Comet	Every 6000 miles or 6 months and every 36,000 miles or 3 years	Sealed	Ford Spec. ESA-M-1C47A or ESA-M-1C75A	Inspect steering linkage every 6000 miles or 6 months. If damaged or loose, replace entire pivot assembly. Lube front suspension every 36,000 miles or 3 years
Oldsmobile	1961	Every 2000 miles	Regular	Chassis lube	
Oldsmobile	1962 (except F85)	Inspect every 8000 miles	Sealed	Chassis lube, water resistant EP type	Lubricate if seals are damaged or parts are noisy
Oldsmobile	1963-65 (all models except F85)	Every 6000 miles or 6 months and every 30,000 miles or 30 months	Regular & sealed	Multi-purpose grease	Lubricate steering linkage every 6000 miles or 6 months and inspect sealed fittings. If latter are okay, lubricate every 30,000 miles or 30 months
Oldsmobile	1962 F85	Every 2000 miles	Regular	Chassis lube	
Oldsmobile	1963-65 F85	Every 6000 miles or 6 months	Regular	Multi-purpose grease	
Plymouth	1961-65	Same as respective year Chrysler			
Pontiac	1961	Every 4000 miles	Regular	Chassis lube	
Pontiac	1962 (all models except Tempest)	Every 35,000 miles	Regular	Pontiac No. 1474829 or chassis lube	Relubricate before 35,000 miles if noise develops. If regular chassis lube is used, lubricate every 4000 miles
Pontiac	1962 Tempest	Every 4000 miles	Regular	Chassis lube	
Pontiac	1963-65 (all models except Tempest)	Every 30,000 miles or 12 months	Regular	Pontiac No. 1474829 or chassis lube	Relubricate before 30,000 miles or 12 months if noise develops. If regular chassis lube is used, lube in 6000 miles or 6 mos.
Pontiac	1963-65 Tempest	Every 12,000 miles or 12 months	Regular	Pontiac No. 1474829 or chassis lube	Relubricate before 12,000 miles or 12 months if noise develops. If regular chassis lube is used, lube in 6000 miles or 6 mos.
Rambler	1961	Every 2000 miles	Regular	Chassis lube	
Rambler	1962-65 (all models except American)	Every 32,000 miles or 3 years	Sealed	AMC lithium base lube; AMC sodium base lube	Lubricate pitman arm stud and front suspension ball joints with AMC lithium base lube. Lubricate front suspension trunnion with AMC sodium base lube
Rambler	1962-63 American	Every 2000 miles and every 32,000 miles	Regular & sealed	Chassis lube and AMC lithium base lube	Lube front suspension and steering linkage every 2000 miles with chassis lube. Grease pitman arm stud of cars with power steering every 32,000 miles with AMC lithium lube
Rambler	1964-65 American	Every 32,000 miles or 3 years	Sealed	AMC lithium base lube	
Studebaker	1961-63	Every 1000 miles	Regular	Chassis lube	
Studebaker	1964-65	Every 6000 miles and every 24,000 miles	Sealed & regular	Studebaker Spec. No. MS-939	Lubricate regular fittings every 6000 miles. Lube sealed fittings every 24,000 miles



PARKING BRAKE CABLES on some models, while not part of usual lube procedure, need periodic greasing

given for this: (1) to check safety equipment such as shock absorbers, and exhaust system, and (2) to check sealed grease fittings of those cars that have them to make sure the seals aren't ruptured and losing grease.

This is an excellent recommendation. However, no one seems to have interpreted "periodic." Since this does involve safety, as well as a safeguard against possible failure of a sealed fitting, it would seem that at least twice a year would be a good rule of thumb.

Now, concerning the actual greasing, here are some things you should be aware of whether or not you do your own work:

Prepacked, or sealed, joints are equipped with screw-on, plastic or rubber plugs. You'll find no grease fittings. This does not mean, though, that such joints can't be greased.

To lubricate these parts, the plug has to be removed. In the case of a screw-on plug, it's simply unscrewed with a wrench. If you have a rubber or plastic plug in the part, it's pried out with a screwdriver and thrown away (photos, pages 162 and 163). A new one is installed after greasing. After the plug is removed, wipe dirt away from the area, insert an adapter (if necessary), which is merely a grease fitting, and grease the joint.

Prepacked parts usually employ a balloon-type seal, which contributes to the extended lubrication interval by retaining the grease. However, this same retaining quality could easily cause rupture of the seal if too much grease is pumped into the joint at high pressure.

For this reason, it's imperative that a low-pressure hand type grease gun be used on this type of joint. Grease must be applied slowly, and greasing stopped as soon as lube is visible around the seal.

Incidentally, if a seal pops, you have to replace the entire part with a new one if you wish to retain the part's grease-holding capability. However, if you don't mind reverting to the old short-interval lubrication, you can equip the part with a regular grease fitting and see if it holds grease adequately.

Wherever you find regular grease fittings, that area is probably equipped with an umbrella-type retainer. Umbrella-type retainers allow excess lubricant to escape, thus preventing damage from over-greasing. Generally, you would use a high-pressure gun on them and stop greasing when you see lube coming out of the fitting or around the part.

Wrong Grease Can Cancel Warranty

If you do your own lubricating and only have a hand gun with which to treat regular grease fittings, there's no reason why you can't use it. It'll just take a little longer to do the job.

The type of grease you use can be as important as how often greasing is done. This is especially true if your car is still under warranty, since using a lubricant other than that recommended generally cancels the warranty.

Most manufacturers recommend a specific type of lubricant for their cars, which go under a company part or specification number. Some, however, such as General Motors, follow a less rigid policy. Buick, for example, advises that if its grease is used, you can abide by the 6000-mile or 6-month guide. If, though, regular chassis grease is used, the company recommends that a 2000-mile interval be observed.

The chart on pages 164 and 165 is offered to put things into proper perspective in regard to greasing and your car. It covers only the period from 1961 to the present, since before this time the 1000 or 2000-mile interval was generally the order of the day.

As you can see, the chart gives the recommended greasing interval guide, the type of fittings you'll find, the grease to use and any necessary special instructions. If you're not familiar with the locations of fittings, write the manufacturer of your car. Or, ask the man at the gas station where you do business to let you look at his manufacturer's charts.

In summing up chassis lubrication, one important fact should be re-emphasized concerning extended intervals. No matter what the auto maker's recommendation, only *you* can judge when your car needs greasing. Perhaps you can go 6000, 32,000, 100,000 or a lifetime without lubrication. But the car should still be lifted periodically and inspected.

If in looking at a part in which there are

sealed fittings you see that grease is leaking out, then the seal is ruptured and the part probably damaged. The part should be repaired or replaced.

If you begin to hear squeaks and squawks from the front, greasing is needed. One sure way to tell is to bounce the car up and down and rock it from side to side several times. If you hear the above noises, relubricate the joints.

Now, as we said last month, there are other parts of your car that need lubrication service. In the old days, this service was, more or less routine, as a starter and generator, for example, might be oiled during every grease job. The man doing the lubrication in those days could work out a procedure for every car coming into his shop and be pretty certain he'd hit all spots on all cars.

'Job Should Be Customized'

This is no longer true. When you take your car in for greasing, you should get a "customized" job—one for your car alone. Not every part that's serviced in one model will be service in another.

Buick, for example, is the only manufacturer that recommends lubrication of the car's brake self-adjusting mechanism. Star wheel contact points and shoe rim rest surfaces should be lubricated every 18,000 or 18 months, whichever comes first, with self-adjusting brake lubricant (Specification No. DM-6807).

Cadillac, Chevrolet, Oldsmobile and Pontiac recommend lubrication of parking-brake cables and linkages (photo, page 166). The interval for this service and the type of lubricant that's used, however, differs from car to car. Caddy recommends lubing with No. 10W motor oil after adjustment. Chevrolet recommends a water-resistant EP type chassis grease every 12,000 miles. Oldsmobile suggests greasing with a lithium-base lubricant at the time of major brake service. Pontiac recommends coating with a white waterproof grease at the time of brake repair.

All Chrysler-built products should have the carburetor choke shaft treated with carburetor cleaner every six months.

In Ford-built cars, including Mercury and Lincoln, the power steering filter inside the power steering reservoir should be replaced every 36,000 miles or 3 years.

Finally there are the real "off-beat" services such as lubricating the rear wheel bearings in the 1963 to 1965 Chevrolet Corvets. These bearings should be greased, according to the manufacturer, every 30,000 or 36,000 miles depending on the year of manufacture. Specialized services such as these are outlined in the manufacturers' charts on pages 164 and 165. ★★ ★

Auto Clinic

Q Has anyone solved the problem of engine surge (hesitation) on the 1963 Ford six? My car's tuned like a Steinway, and to a pitch where I'm getting maximum fuel economy. But this problem persists.—H.H.S., Ohio

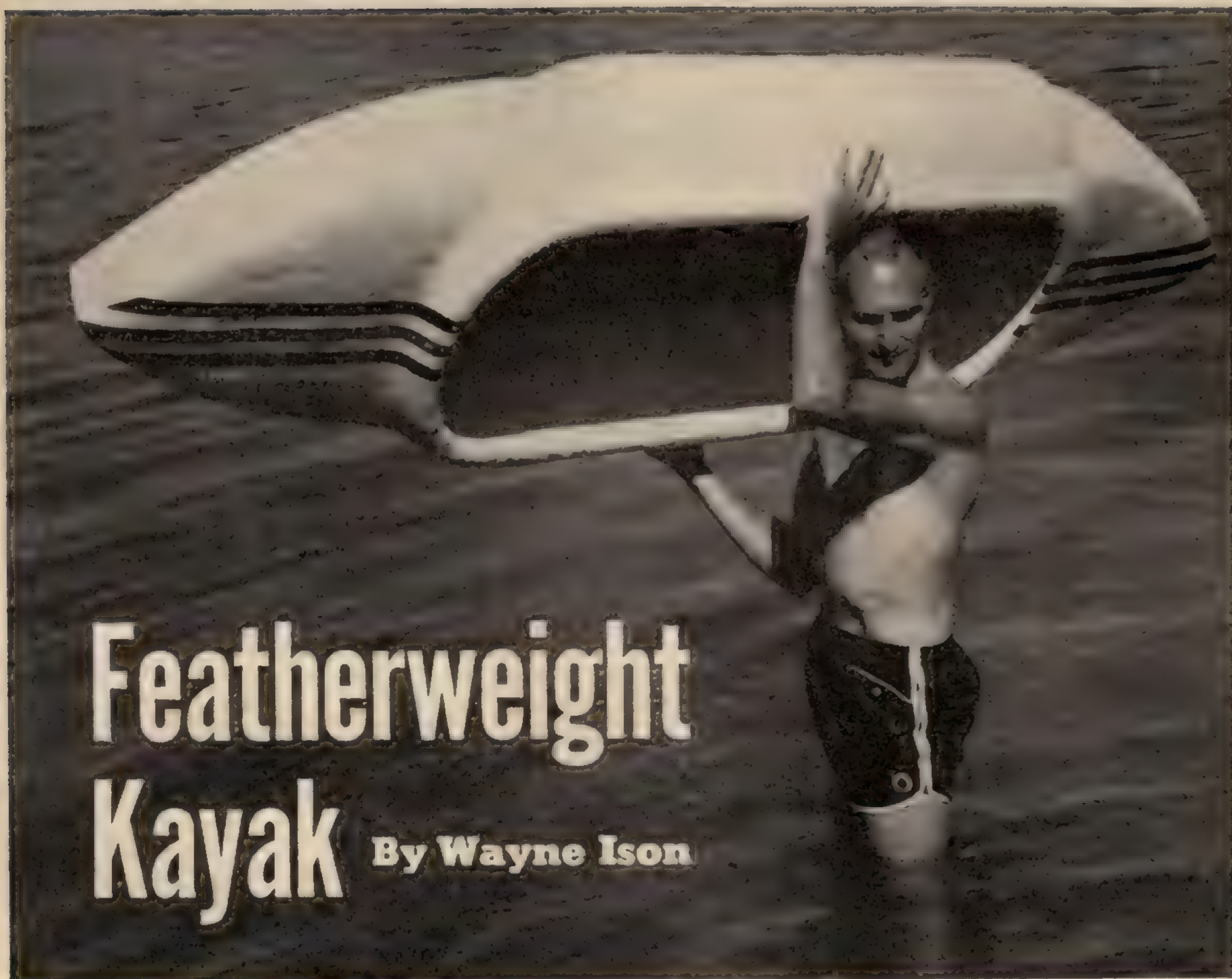
A Harken, all ye 1963 and 1964 Ford six owners with 144 and 170 CID engines. Hesitation can occur at part throttle, steady speed or wide open throttle if your car's fuel mixture is set lean enough (according to specs) to get maximum fuel economy. The problem's caused, in fact, by this lean fuel condition. Here's a beauty of a solution which seems to work and still maintains the car's maximum fuel mileage performance. First change the main metering jet to one size larger to admit just a bit more fuel. Then add four more calibrating shims (part no. 375910S) to the four already in the power valve rod. However, in no case should there be more than eight of these shims or fuel mileage will suffer.

Q The problem with my 1960 Corvair is a sticking gas pedal. I've already tried a new and stronger return spring, but it hasn't helped. Any thoughts?—J.P., Conn.

A Quite a prevalent problem, and the trouble areas have been found to be two. First, dirt that accumulates directly below the pedal linkage can cause binding. Clean it out and see if that solves the problem. If not, the trouble lies in the linkage tunnel. Dirt or something else is causing the linkage to stick, so clean it out.

Monthly Service Tips

★ We've received letters from Cadillac owners (those with cars from 1958 through 1960) asking for information regarding conversion of air suspension to coil suspension. Kits available at Cadillac dealers permit such a switch on any Caddy of these years, *except the Eldorado Brougham*. Your dealer has been advised of this conversion through a letter of instruction from the manufacturer. Kit part No. 3631824 is for application to 1958 models. No. 3631825 is for '59 and '60 models.



Featherweight Kayak

By Wayne Ison

TALK ABOUT EASY construction. Here's a featherweight fun-boat that is basically nothing more than a big block of foam carved to shape. Of course, you'll have to add a plywood bottom and a couple of fat stabilizing sponsons before putting it in the water, but this \$36 floatabout is probably the simplest thing to drift down the pike since the dugout canoe.

Begin construction by laying out a template of the top curve of the hull on stiff cardboard. Transfer these lines to all four corners of the foam block. Once this is done, lay out the cockpit cutout on the foam and you're ready to start cutting.

A bandsaw is ideal for rough-cutting the outline of the boat. Your lumberyard may handle this for you. Naturally, you can also do the job with a handsaw, but it takes a lot more time. One shortcut when cutting the foam with a handsaw is to first go around the outline with a saber saw, using a long wood-cutting blade, and then let this cut act as a guide.

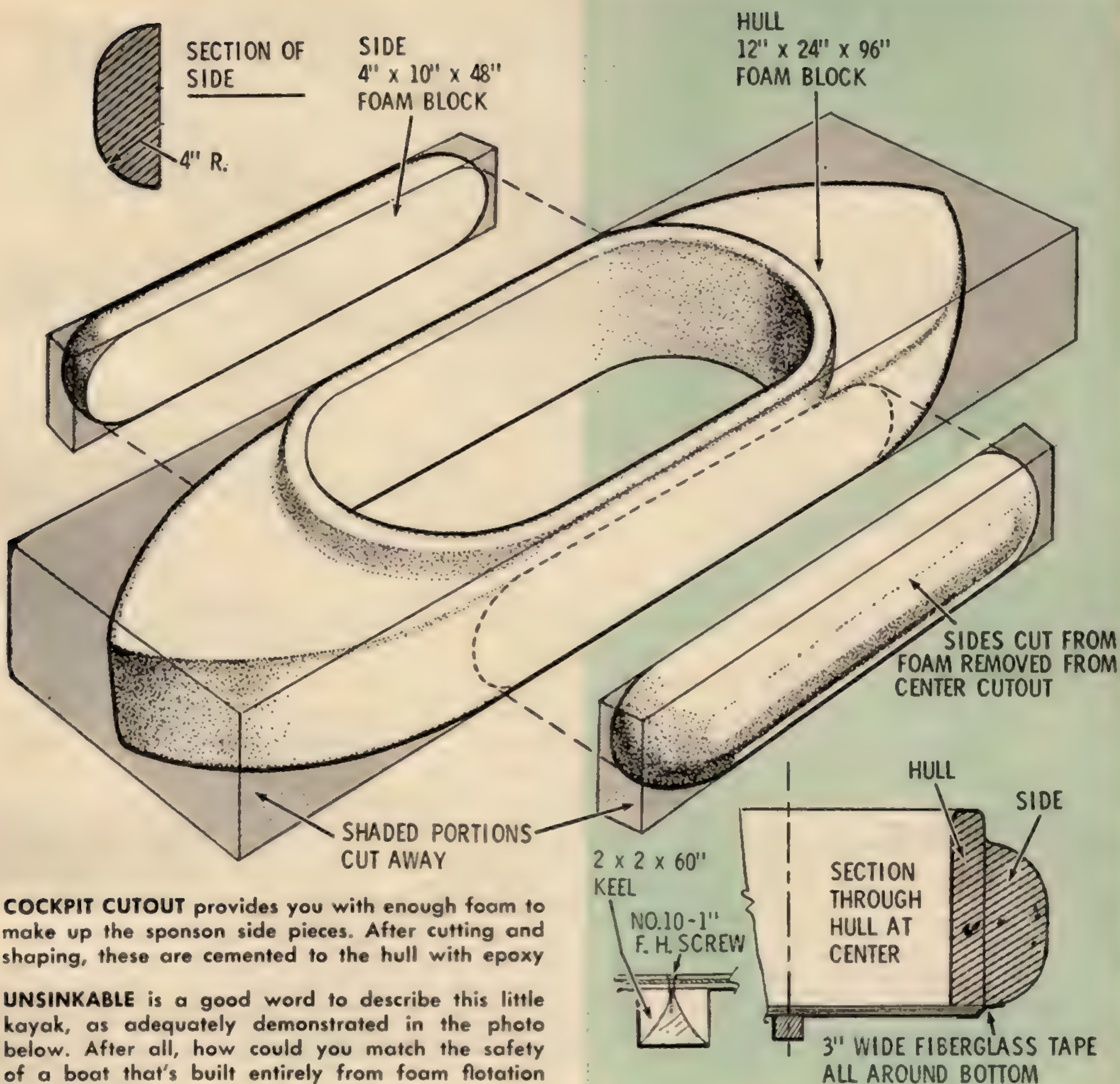
If you have a good eye, you can do the rest of the shaping without bothering to cut templates. Otherwise, make up templates and carve slowly, checking your progress frequently against the templates. A keyhole saw is fine for whacking off big chunks during initial shaping. For final

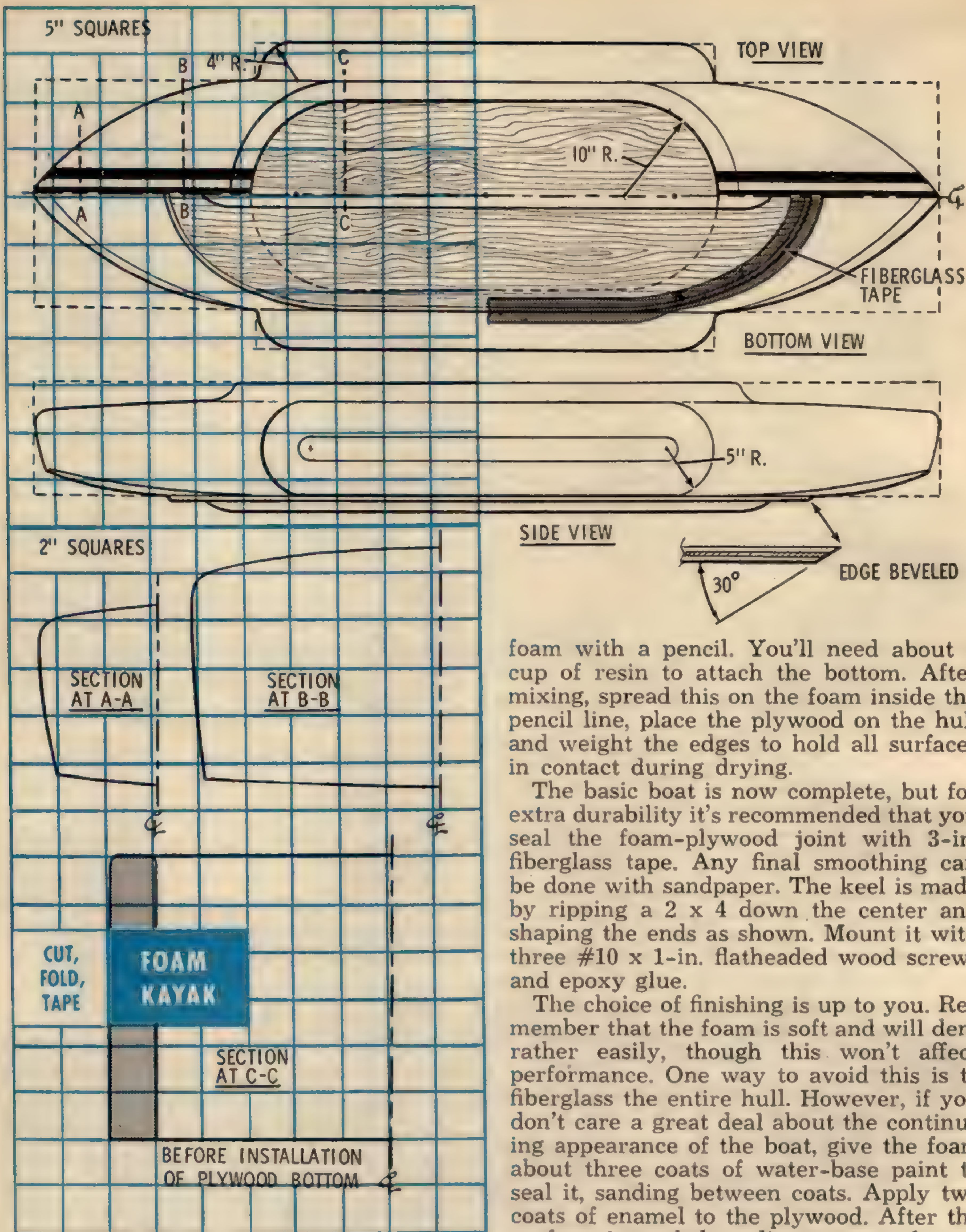
smoothing, however, the best tool is a rasp-type file, such as the Stanley "Surform" or Sears "Rasplane." Remember that the foam cuts quickly, so take your time when hacking away.

Next, cut out the center portion of the block and lay out the sponsons on this. Follow the same procedure in shaping these as you did on the hull, holding them against the sides of the hull frequently to check the fit. You may find it necessary to do a little sanding to obtain perfectly flat surfaces for an even joint.

Mount the sponsons to the hull with epoxy resin adhesive, since other types of glues will either dissolve the foam or fail to hold. You can obtain this in suitable quantities at any marine supply store. Mix about two thirds of a cup of resin and spread it on one sponson, concentrating most of the material around the edge and letting the remainder go to the center. Then place the sponson on the side of the hull and hold it in place with clamps or weights. Very little pressure is required, so don't overload the foam.

Once both sponsons are in place, cut the plywood bottom from $\frac{1}{4}$ -in. exterior plywood and bevel the edges as shown in the drawing on p. 170. Put the plywood bottom on the hull and mark the outline on the





foam with a pencil. You'll need about a cup of resin to attach the bottom. After mixing, spread this on the foam inside the pencil line, place the plywood on the hull and weight the edges to hold all surfaces in contact during drying.

The basic boat is now complete, but for extra durability it's recommended that you seal the foam-plywood joint with 3-in. fiberglass tape. Any final smoothing can be done with sandpaper. The keel is made by ripping a 2 x 4 down the center and shaping the ends as shown. Mount it with three #10 x 1-in. flatheaded wood screws and epoxy glue.

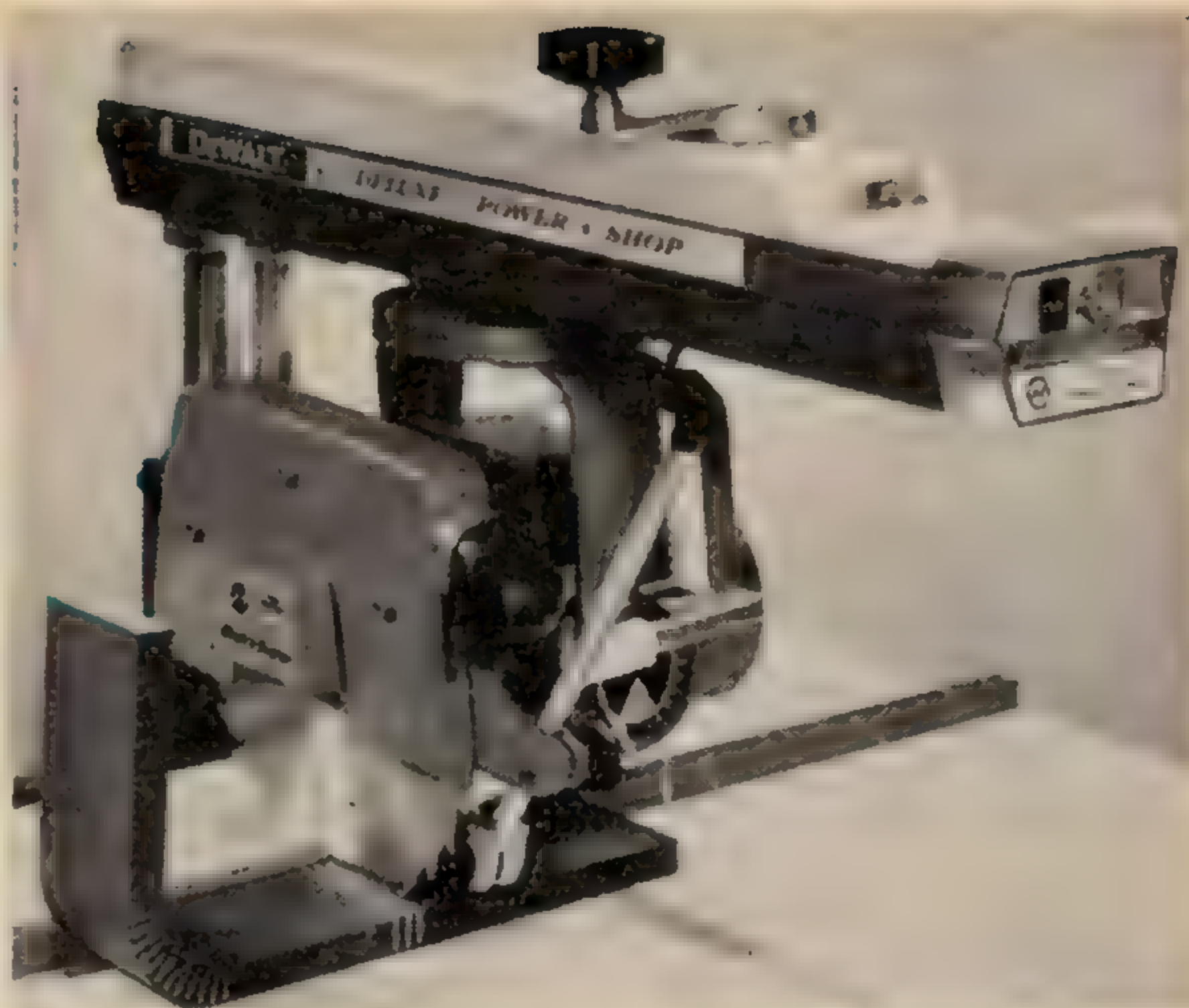
The choice of finishing is up to you. Remember that the foam is soft and will dent rather easily, though this won't affect performance. One way to avoid this is to fiberglass the entire hull. However, if you don't care a great deal about the continuing appearance of the boat, give the foam about three coats of water-base paint to seal it, sanding between coats. Apply two coats of enamel to the plywood. After the surface is sealed, ordinary enamel may also be used for trim. ★ ★ ★

MATERIALS LIST

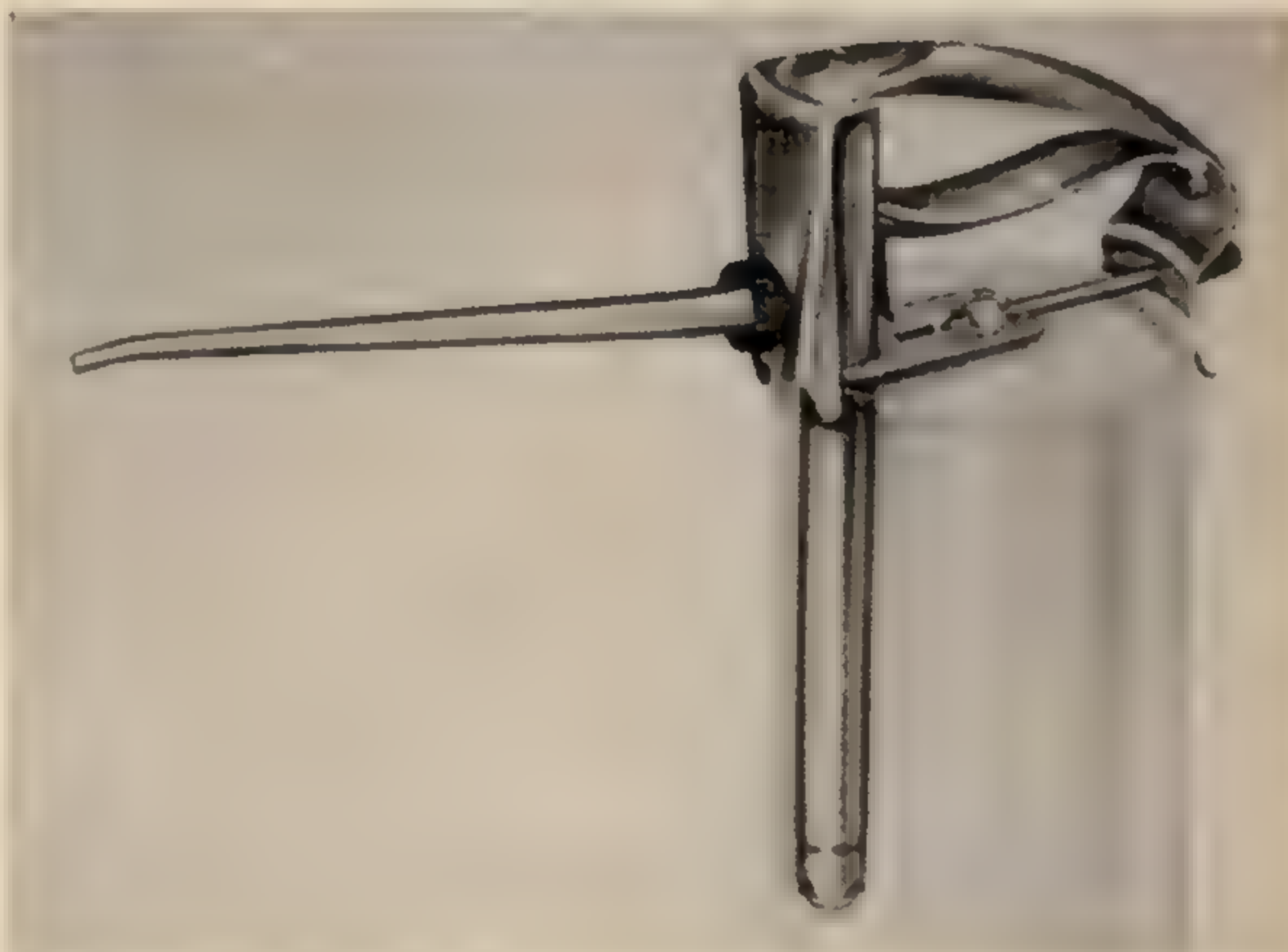
No.	Size & Description
1	12" x 24" x 8' Styrofoam block (Formex Corp., Box 812, Elkhart, Ind.)
1	1/4" x 24" x 68" A-A exterior plywood
1	2 x 2 x 60" fir (keel)
Epoxy resin and fiberglass tape available from Sears Roebuck or Montgomery Ward.	

Shopping for Tools

No Reaching Past the Blade with the De-Walt Model R-1450 radial arm saw because all controls are mounted in front. Other features of the 10-in. unit are a totally enclosed $2\frac{1}{4}$ hp motor and a built-in automatic brake that stops the blade as soon as power is shut off. Priced at \$279.95. Manufactured by Black & Decker Manufacturing Company, Towson, Md. 21204.



Any Quart-Size Oil Can becomes a lever operated pump oiler when fitted with the Superior Lancer dispenser. The unit is attached by piercing the end of the can as is done with a conventional pouring spout. Price is \$3.95 plus \$1 for an optional flexible nozzle for lubricating hard-to-reach spots. Available from dealers or Superior Engineering, North Branch, Minn. 55056.



Neatly Stowed Away in a folding plastic case are three slotted screwdriver blades in different sizes, two Phillips screwdriver blades, a reamer and an awl. Any one of the tools can be inserted into the handle that comes with the kit. For added leverage the tool can be inserted crosswise in the handle. Costs \$2 from Triple M Import-Export Co., 1020 "B" St. Hayward, Calif.



Combination Wrench, Pliers and hand vise is said to hold small work in a tight grip and to tighten or loosen nuts and bolts as fast as a ratchet. Called the Flare Wrench No. 2208, this drop-forged tool retails for \$6.25. Available from Witherby Products Div., John H. Graham & Co., 105 Duane St., New York, N.Y. 10008.



Adjust the Power to the Job with either one of two new Craftsman staplers. The power-driven model (as shown in far-right), has a convenient dial that regulates the power surge. Price is \$60. In the hand-powered model (\$11), which features an unusual trigger action, a pushbutton selects regular or high power. Sears, Roebuck, 925 S. Homan Ave., Chicago, Ill.





Land Racing Yachts

By Hi Sibley

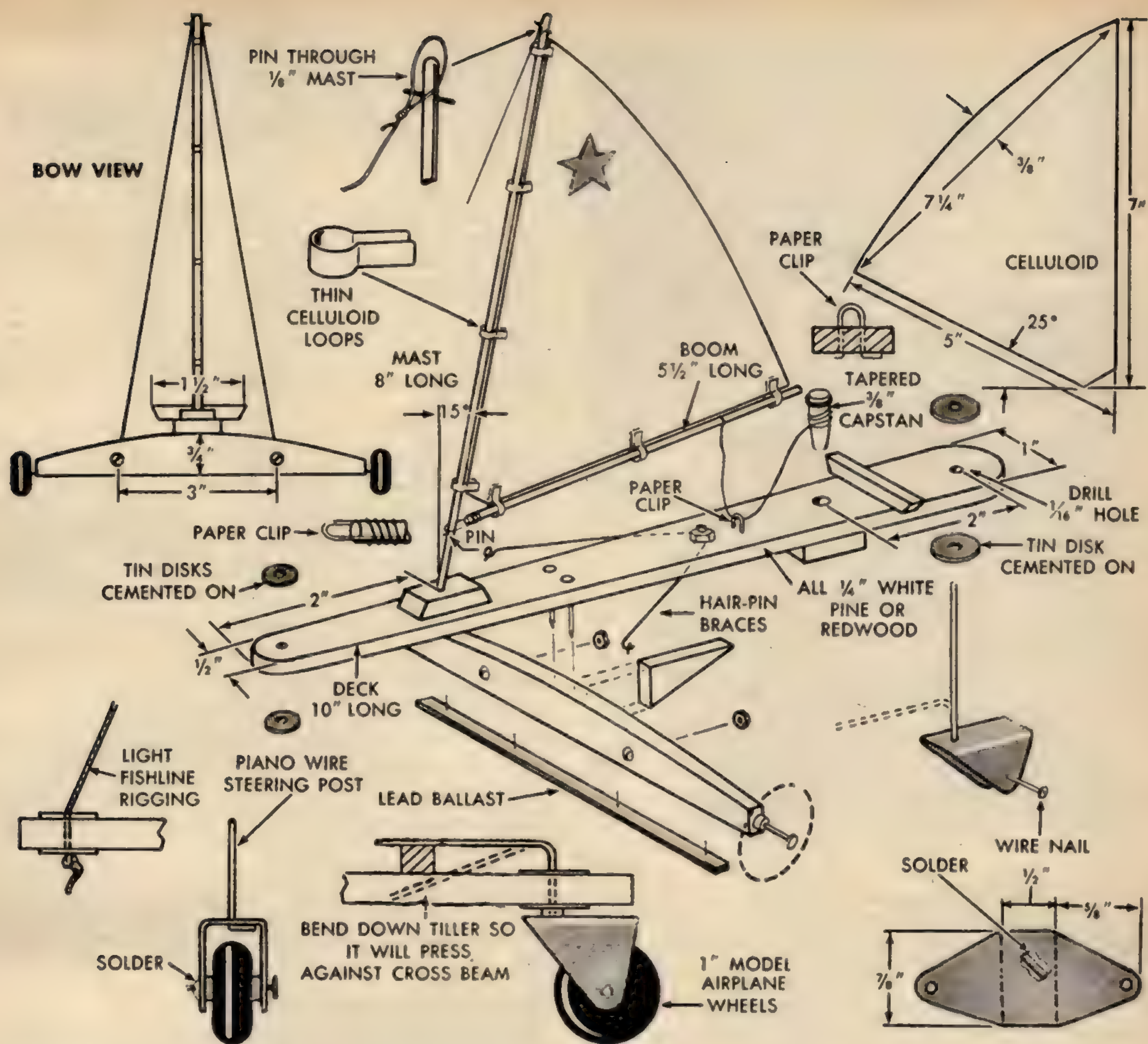


LAND YACHTS are fun to make and exciting to race. Teamed up with a breezy day and some smooth pavement, they will provide your youngsters with hours of amusement.

Their construction is strong but surprisingly light, making a strip of lead ballast an absolute necessity if capsizing is to be avoided. With the exception of the capstan, which is made to be a snug, friction fit, all wooden parts are nailed and glued. The sail is secured to the mast with celluloid loops cemented in place.

The housing for the rudder wheel is made from a scrap of tin. Piano wire soldered to the housing forms the steering post which is bent downward so that it bears strongly against a balsa crossbar. This assures that the rudder wheel will remain in the desired position.

Colorful shades of enamel will result in an attractive finish; you might try painting the deck yellow, cross beam and rudder housing red. Top off the sail with a red star.



CUT PARTS to dimensions shown. Cross beam should be 6-in. long and attached at a point 3-in. from the end of the deck. Don't overlook the pins driven into the mast to prevent rigging and boom from slipping down

NEXT MONTH IN SHOP AND CRAFTS

- ★ **WINDOW MAGIC.** Nothing makes your house show its age like old-fashioned undersize windows. In step-by-step photos, we'll show you how to replace these with an attractive picture window that gives your home not only a new look, but a new view as well. It's a simple matter of sawing out the old windows and inserting the new—with no replastering required
- ★ **DELTA-WING ROCKET.** The latest thing in a flying model is this needle-nosed ducted rocket that climbs the sky in realistic flight, with everything in scale—including a jet trail and sound effects! Construction isn't fussy—you use an ordinary mailing tube as a building form, and mount your choice of standard jet engines. Full plans in July's issue
- ★ **TV CART MAGAZINE RACK.** This is the season you spend your leisure time outdoors. But most of the things you're used to relaxing with are left inside—your television set, for example, and your favorite reading matter. This easy-to-build TV stand is on wheels—lets you roll your set (and a built-in magazine rack) right up to the hammock
- ★ **ELBOW ENGINE.** Even though it has no practical use whatsoever, this six-cylinder "expansion engine" is a metalworker's delight. It contains only five moving parts and runs on air, steam or any pressurized gas, smoothly converting reciprocating action to rotation. All you need to build it is a lathe, so be sure to check the plans in PM's July issue



When and How

Changing is easy when you know how. Here's what to do with eight of the most popular types

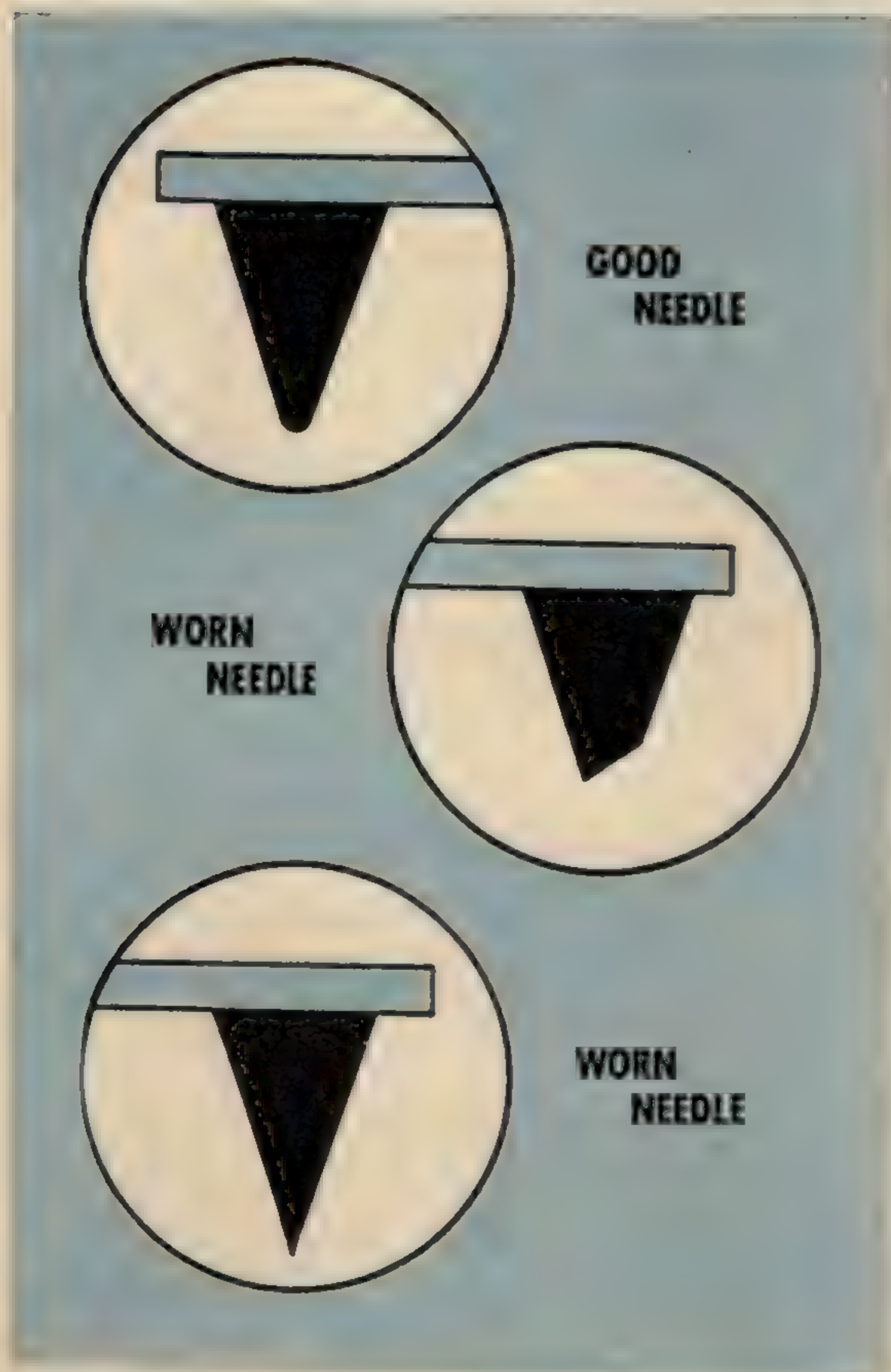
By Homer L. Davidson

WHEN SCRATCHY, NOISY SOUNDS greet you from your record player instead of the sweet or hot music you like to hear, the chances are that it's time to put in a new needle. This is an easier job than you might think, no matter what type cartridge your phono uses. Pictures on this and the following pages show the exact steps to take to change the needle in eight popular types of cartridges.

Before you buy a new needle, however, make sure you really need it by trying a few "scratch" tests on your player. First, play a *new* record and listen carefully. If

IS OLD NEEDLE BAD? You've got to know that before changing. Note that good needle has smooth, gently rounded tip. Worn needles develop sharp edges and chisel tips. Examine them under magnifier

STYLE 1: To remove, push down on needle assembly and turn sideways. Grasp old needle at end with fingers and pull outwards. Push new needle into slot. This style is used only in G-E cartridges



to Replace Phono Needles

the noise has disappeared, the needle is still good and your old records are worn. If the noise continues, change that needle right away before it can increase the damage to your favorite platters.

For another check lift up the pickup arm, which holds the cartridge and needle assembly, and set it down in the middle of a new record. After playing the record for a minute, remove the arm. If the entire record surface still looks shiny and new, the needle is good. If the section just played is noticeably duller than the rest of the record, the needle is bad.

For another test wipe off the record just played with a clean white cloth. If you find small scrapings from the record on the cloth, the needle is worn.

If you have a high-power magnifier, examine the needle point and compare it to the diagrams on page 174. You'll have no trouble spotting a worn needle.

Once you're certain a new needle is re-

quired you must decide what type to buy—usually diamond or sapphire. The diamond will cost more, but it will last much longer (about 1000 hours of playing time or 2000 LP record sides). It's likely to be the best buy when considering cost. However, a child's phono is a good place for a sapphire needle.

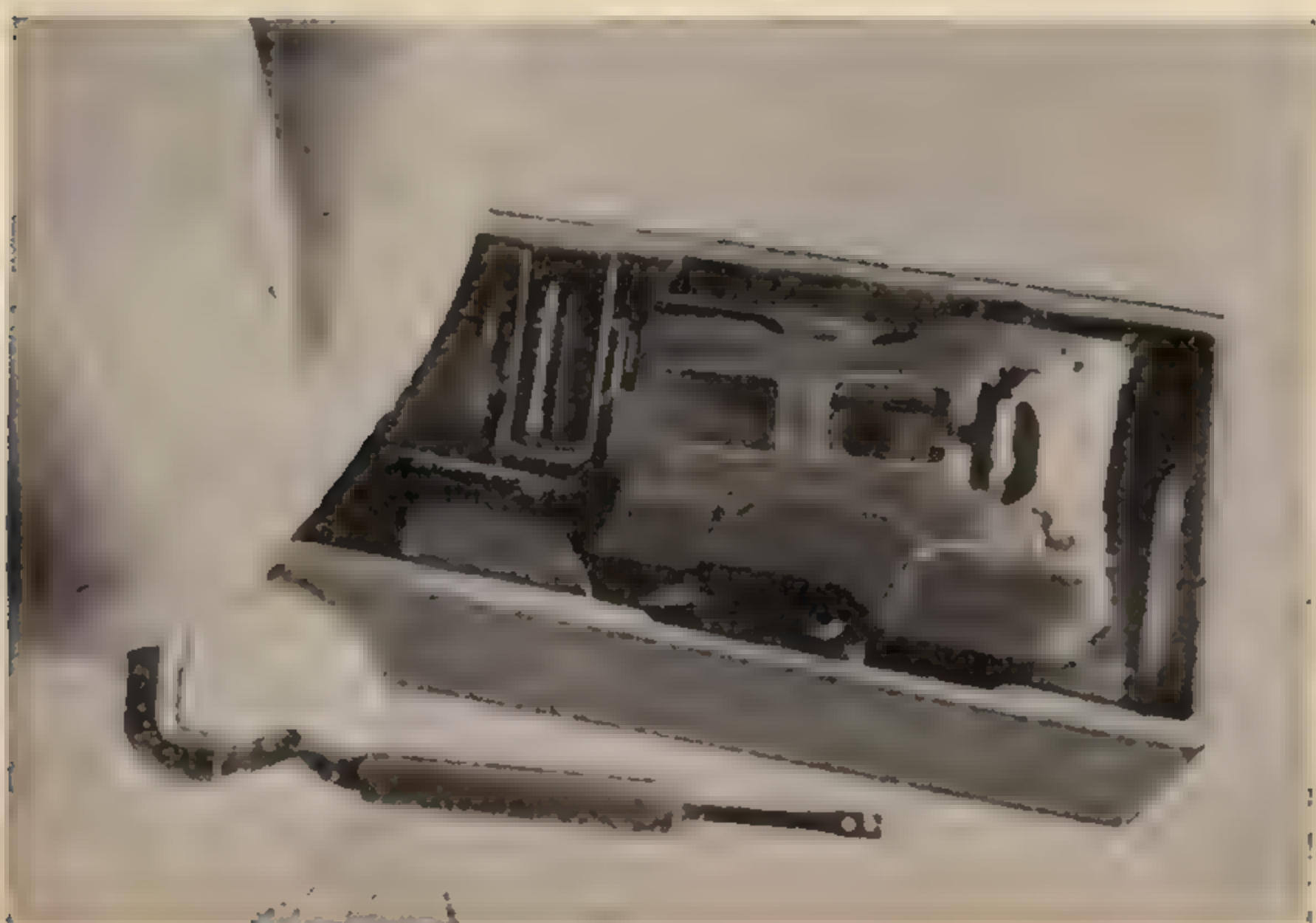
To be sure of a correct replacement, you'll need to have the part number of the original needle, the make and model of your player, or the needle itself. The part number is often listed in the literature that came with your phono, while a model number is usually found on an identification tag attached to the cabinet. If you're not sure of the needle, take the phono to a music shop and ask a clerk to identify it.

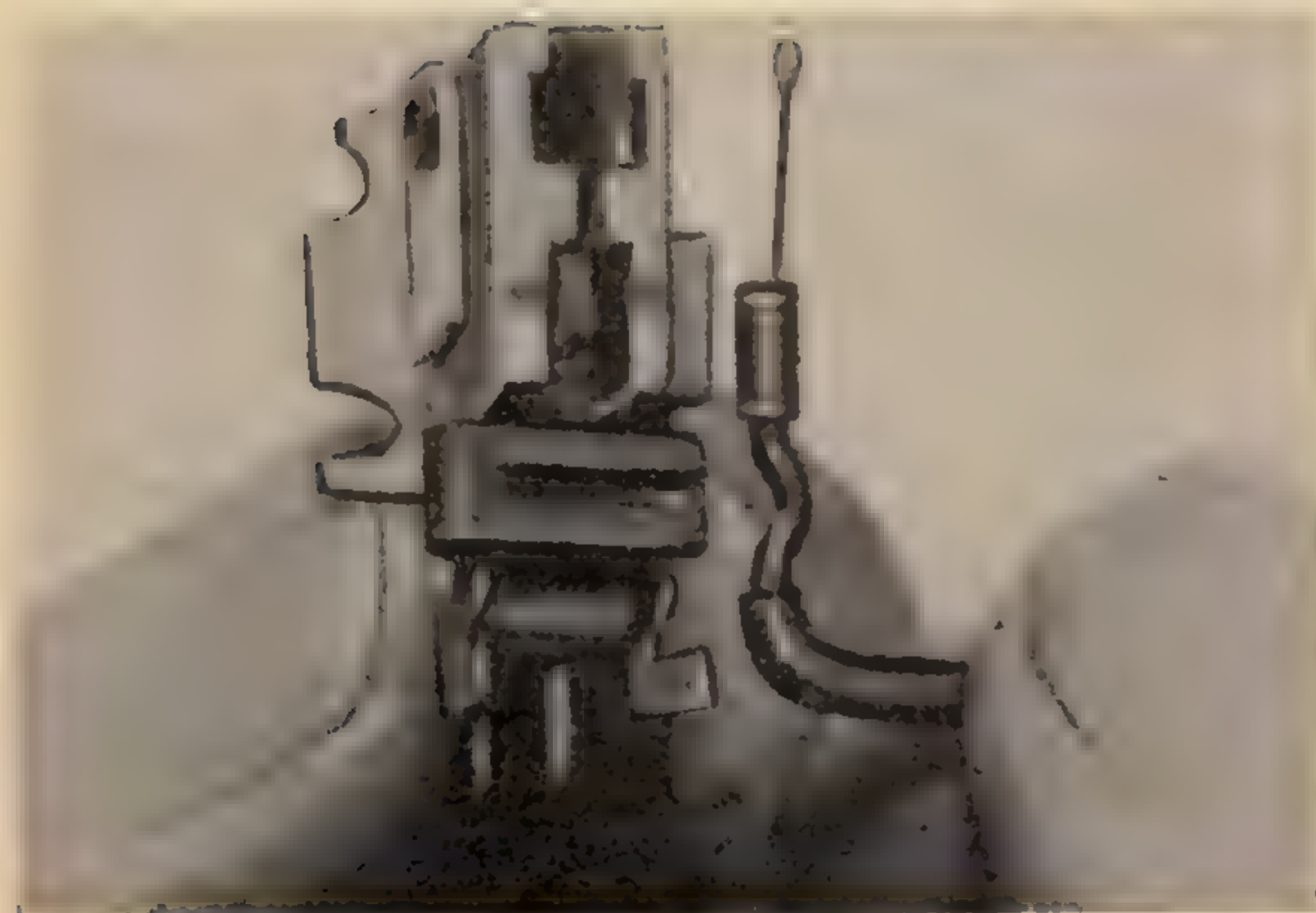
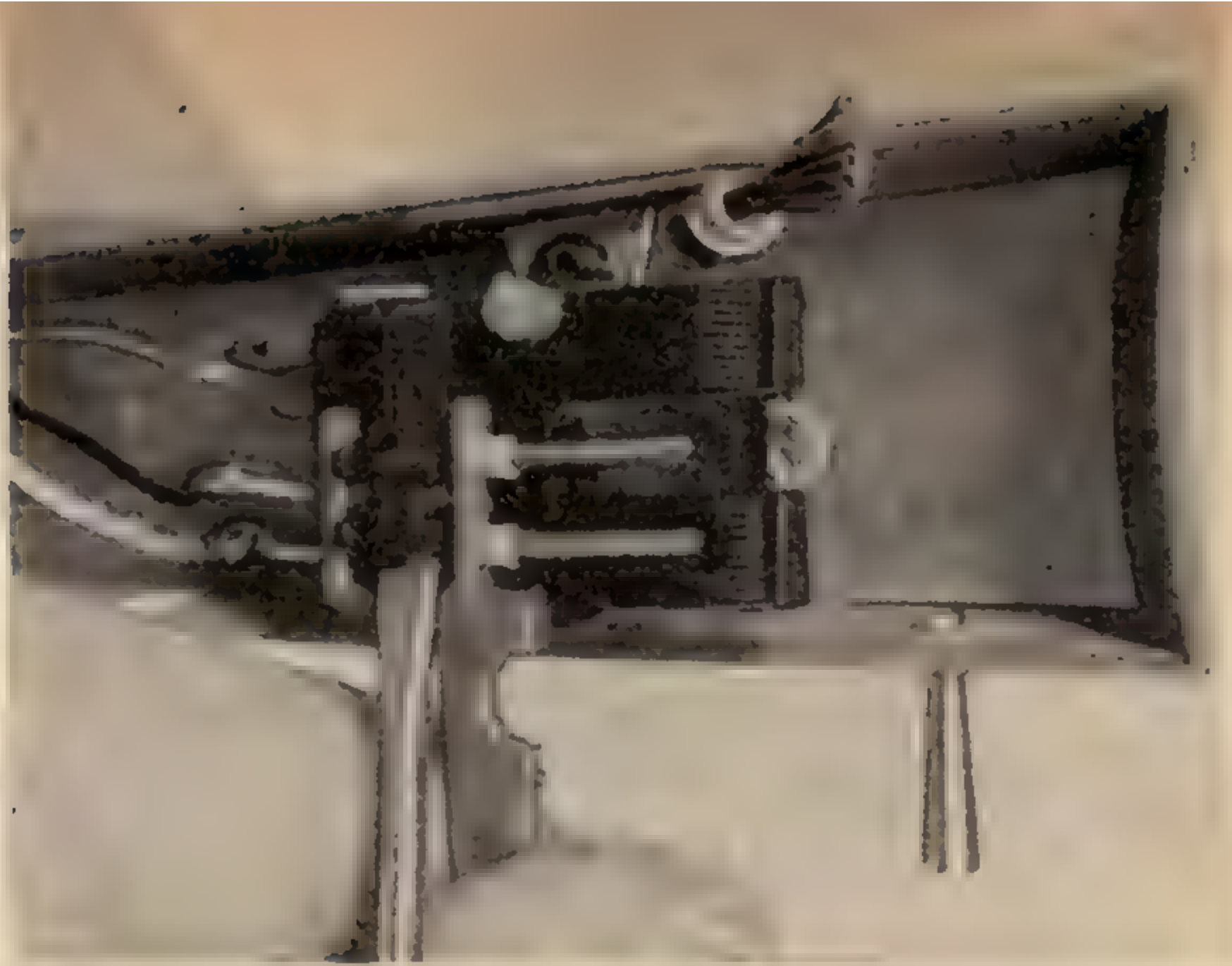
To replace the needle, set up the phono in a well-lit work area. Carefully lift the pickup arm and be sure to hold it firmly. If it should drop, you may break the cartridge or damage the arm. Look at the

STYLE 2: Lift the clip with fingernail or small screwdriver and pull up. Turn needle lever upwards and pull needle out. Insert the new needle next. Lift clip upwards and slip small "V" under spring



STYLE 3: Pry up end of needle flange with small screwdriver to remove needle. Be sure to hold your handkerchief below pickup arm to catch the small needle. To install, simply snap new needle in place





STYLE 4: Grasp pickup arm with left hand and push up on needle guard with fingernail. Turn needle upward and pull it out. Then insert the new needle underneath the small clip and seat it in the yoke

STYLE 5: Slip small screwdriver or fingernail under small clip and pry up. Pull needle out. Then hold clip up and insert new needle. Make certain replacement needle is resting in yoke of the cartridge

defective needle and match it with the appropriate photo on these pages. Then follow directions in the captions.

After installing a new needle, check that all wires to the cartridge are intact. If you have a monophonic set, there will be two wires in the arm; a stereo set may have three or four wires, or even five. There will be two terminals on monophonic cartridges and four on stereo models. When you have three leads, a jumper connects two cartridge terminals together.

With the new needle in place, turn on the phono and play a record. If stereo, check both channels for good volume. If no sound develops, check the wiring to the cartridge again. If the wiring looks okay, turn up the volume control and touch the cartridge terminals with a small screwdriver. This should produce a loud hum in the speakers. If no hum the fault is either a break in the wiring connecting the cartridge to the amplifier or in the amplifier itself.

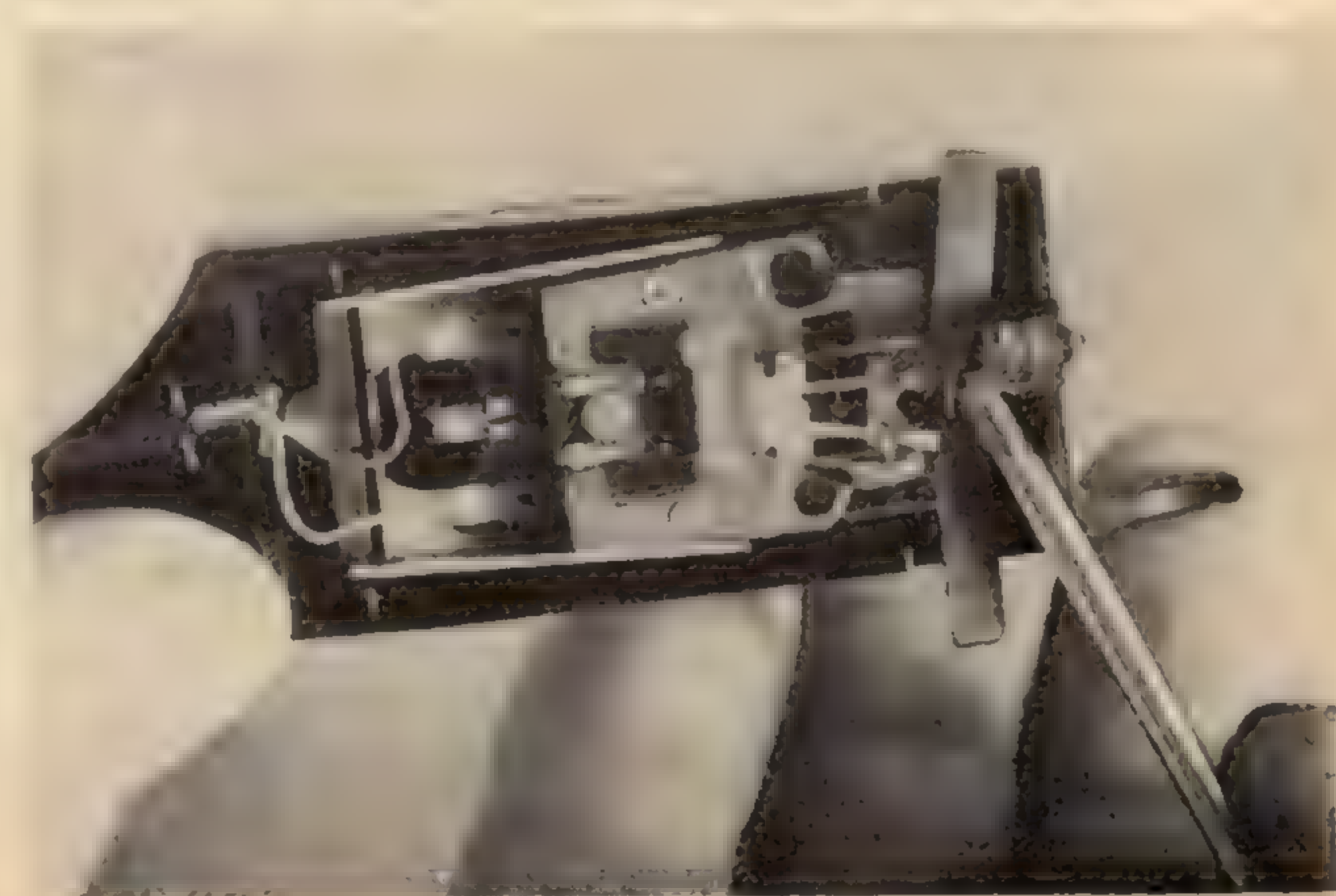
If you get a hum, but no other sound when you play a record, the cartridge is bad and must be replaced. Double check this by running your finger lightly across the needle. A good cartridge will produce a rippling sound. A bad one won't give any sound at all.

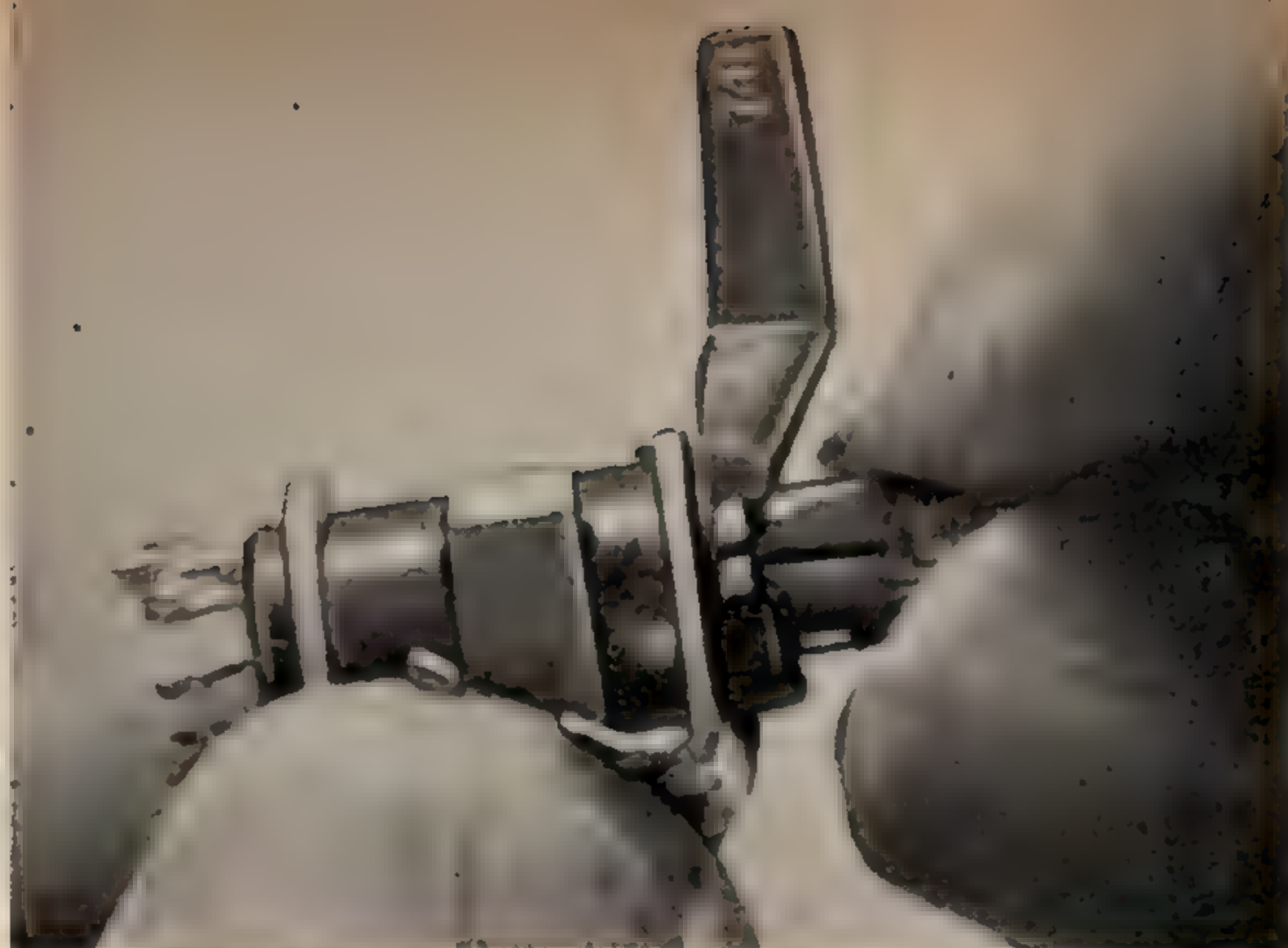
To prolong the life of a new needle, it is vital to keep your records clean. Use a

good record brush on each record before and after playing. Keep records in their jackets when not being played. Occasionally, check the needle for dust. It can be cleared away with a small artist's brush. Keep the record player lid shut as much as possible.

If your older records have become very dirty, wash with lukewarm water and a mild soap. Rinse thoroughly to remove all traces of soap and allow them to dry. Clean them again with your record brush before storing. ★★★

STYLE 8, STEP 1: With fingernail or screwdriver pry up and remove cartridge clip holding the needle assembly in place on cartridge and into pickup arm





STYLE 6: This needle must be turned 90° before it can be removed. Turn its plastic handle straight down and pull needle straight out. Insert the replacement needle into small guides and turn 90°

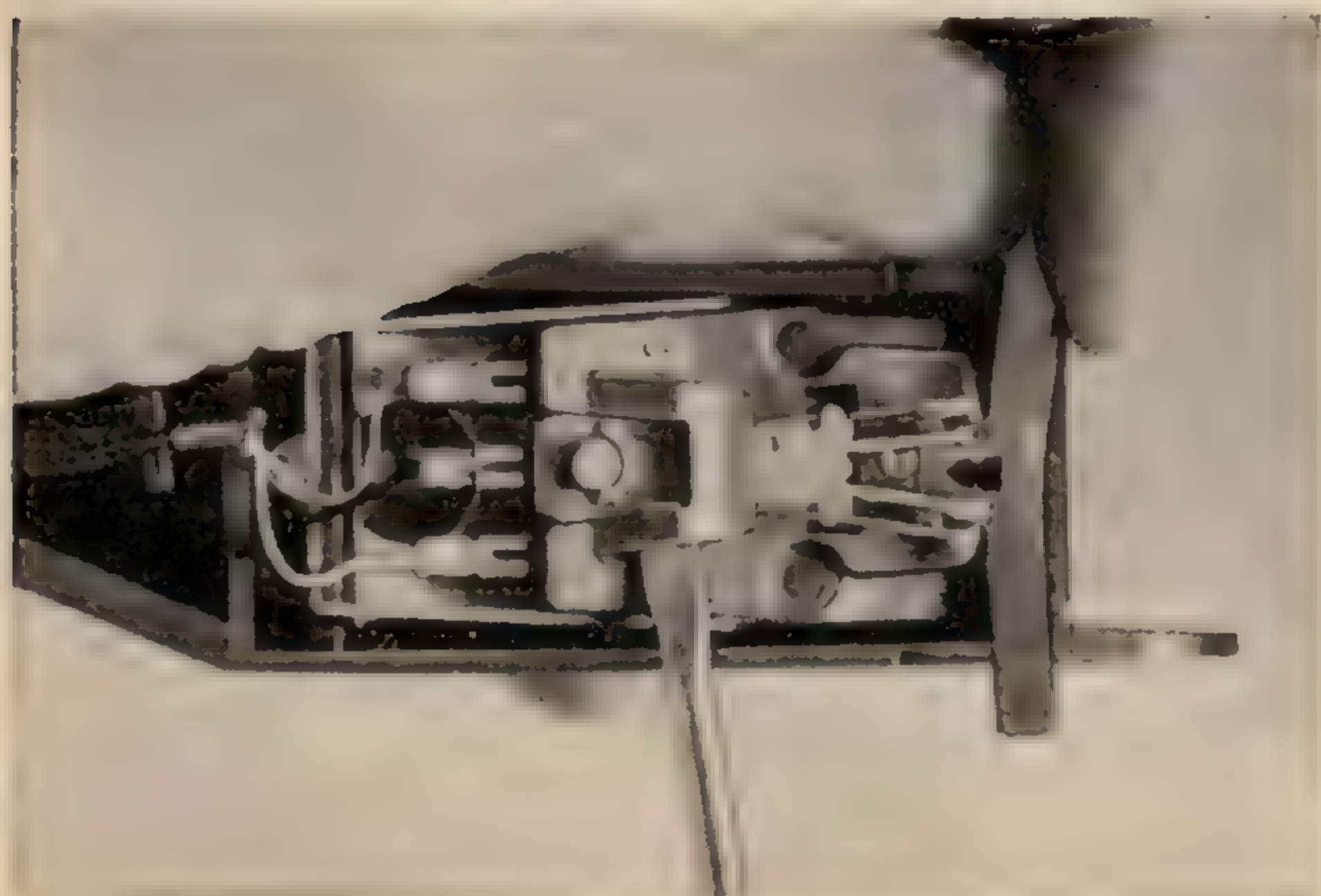
STYLE 7: Grasp front of needle assembly and pull down. One-piece needle and cartridge will slip out of plastic holder. New assembly slides directly into the holder. Guide ribs insure proper alignment

MANUFACTURERS' PART NUMBERS FOR NEEDLE TYPES PICTURED

	STYLE 1	STYLE 2	STYLE 3	STYLE 4	STYLE 5	STYLE 6	STYLE 7	STYLE 8
Astatic	N-350-SS	N-676	N-8-1S	N-674	—	—	13T	N-562
Duo-Tone	662	857	743	585	—	867	812D/S	816D/S
Electro-Voice	2729	3211	3006	3201	—	3220	1305	2906
Fidelitone	C-180	AC-255	A-254	AC-130	—	AC-304	AC-256	AC-253
Jensen	G-3	S-71X	CRA-57LP	S-66	EU-2X	S-80X	A-44X	M-77X
Recoton	419	535SD	509	385	—	554	—	533
Walco	W-68S	W-103STSS	W-104MGS	W-75TPS	—	W-149STSS	—	W-117STS

STYLE 8, STEP 2: Next, lift spring up with the nail or screwdriver, grasp wing of needle assembly and pull up. The assembly will come straight out

STYLE 8, STEP 3: To replace, insert needle assembly under clip, push it into slot and seat it in plastic cartridge. Be sure needle rests in yoke



New in Electronics

SIXTH WHEEL IS RADIO in disguise. Wheel disc tunes stations; hub cap is the volume control. Nine-transistor circuit pulls in stations even in weak signal areas where you wouldn't expect a transistor set to operate. Powered by four penlight batteries, Mascot weighs 1½ pounds, costs \$39.95. Mayco, Rowland Heights, Calif.



PORTABLE HI-FI stereo system includes speakers, dual 20-watt transistor amplifiers, and turntable. Housed in two matching cases, it's the ideal way to take good music wherever you go. Frequency response is ± 2 decibels from 30 to 20,000 cycles. Speakers can be located in any convenient spot. Each unit has 8-in. woofer and 3-in. tweeter. Record player will track even with ½-gram stylus pressure. Complete stereo system \$389, Shure Brothers Inc., Evanston, Ill.



SATELLITE SPEAKERS are convenient extenders for enhancing the stereo effect in a hi-fi stereo system. Less than a foot and a half tall, they go almost anywhere—even behind furniture. Speakers face upwards and radiate music in a 360° circle. Speaker cabinets come in walnut, mahogany and maple finishes, are priced in pairs beginning at \$49.90. Available from International Electrohome Inc., Elk Grove, Ill.



Made for fishermen



who have skiing problems.

Fishing and water skiing seldom mix.

Especially when fishermen and skiers live under the same roof and share the same boat and motor.

The rig that's big enough for father's fishing lacks the get-up-and-go for junior's skiing. And the rig that's right for skiing is all wrong for fishing.

Something's got to give. And unless you play the cards exactly right, it could be the fishing!

We've just invented the perfect solution—the new Evinrude SKI-LARK (what a sneaky name for a fishing boat), powered by a 40 hp Evinrude LARK motor.

It has brawn enough for slalom skiing. Glamour ap-

pointments you can hose down. Stability and flat-floor room far beyond the usual limitations of its 14'-7" size. Yet it's compact and maneuverable as a car-top skiff for "way back in" fishing. And it has the Evinrude GULL WING ride that lets you go in comfort in waves and wakes and white water.

Fishing boat, skiing boat, or luxury runabout—it's all of these things on a moment's notice. With windshield that folds flat, seats that move around, and push buttons that answer to a finger's touch — it's versatile enough for everything from reef diving to moonlight driving.

Just in case you're looking beyond the skiing problem!

FREE! Two new catalogs. 1965 motors and boats. At your dealer, or write Evinrude Motors, 4148 N. 27th St., Milwaukee, Wis. 53216.

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POWERFULLY SMOOTH

with the ride that feels like a car...the Six that feels like an Eight

You've never ridden in any pick-up with so much car-like comfort.

Its secret: two front axles—a Ford exclusive—that work independently to make the roughest roads ride far more smoothly.

Even on the best of highways, you'll enjoy the unique ride of

Ford's Twin-I-Beam suspension. Gone completely is all riding harshness and pitch.

What's more, this truck corners without mushing out. It brakes to sudden stops without the usual dipping or diving.

Ford's new seven-main-bearing

ing Sixes have the feel of a smooth-stroking Eight—the traditional economy of a thrifty Six. Or you can have a new 352-cubic-inch V-8, most powerful pickup engine Ford has ever built ...surprisingly economical too.

See it at your Ford dealer's!

'65 FORD

TWIN I-BEAM
INDEPENDENT SUSPENSION

PICKUPS
BUILT TO LAST LONGER



Reason for Ford's smooth ride is exclusive new front suspension with two independent front axles. Shocks at one wheel are not transmitted to the other. Axles are forged I-beams as used in big-truck axles. Result: big-truck durability with car-like ride.

PRODUCTS OF  MOTOR COMPANY

RIDE WALT DISNEY'S MAGIC SKYWAY AT THE FORD MOTOR COMPANY PAVILION, NEW YORK WORLD'S FAIR

Buying Binoculars

(Continued from page 123)

If the binocular has passed so far, it's time to look *through* it, as you would in the field.

Since a dropped pair of binoculars is embarrassing, put the strap around your neck. Then, get permission to go outdoors, if possible, as most of the following tests involve using the glasses at full range.

Outdoor Tests

Adjust the binocular to your eyes in this way: flex the barrels on their hinge until you can see one clean sharp circle—not two like in the movies. Now, cover the right objective lens with your right hand, and focus the left lens by rotating the center wheel in C.F. models or twisting the left eyepiece in I.F. models. Sight on a far-distant object—at least a city block away—and adjust back and forth until it appears very sharp. Then reverse the procedure, covering the left lens while you turn the right eyepiece. In C.F. models, this will require a slight adjustment, unless your eyes are very different; in I.F. models, it will take as much twisting as the left lens.

At this point, if the eye relief (the distance from your eyes to the eyepiece) suits you, adjust the eyecups (if any, and if they are adjustable) until you get a full field without having to shift the glasses back and forth. You should have the sensation of looking through a large, clean, circular plate-glass window on a clear day. There should be no pain or strained feeling in your eyes.

In other words, you want more than mere magnification. Distant detail should be as plain as if the object were close by. Mortar lines on brick buildings should be distinct. You should be able to read license plates a good distance away. Shadows should "open up" so you can see detail in them. If these things are not observed, here is what may be the matter.

Faulty collimation: Properly assembled and adjusted binoculars should have both barrels looking at precisely the same field of view. If not, the viewer feels a twisting sensation in the eyes and sees the vague impression of two images as his eyes try to bring the images together.

For a quick check, set the binoculars on a flat surface with the barrels level. With one eye closed, align the field of view with the other so there is an object at the top of the field. Then shift that eye to the other barrel without moving the instrument. If the object is now to one side, half out of sight or well down into the field, the

(Please turn to page 182)



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FIST WITH A
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Feel hammering at its best. Driving power. Precise balance. And pure comfort in the special cushion grip—won't slip in your hand ...wet, dry or gloved. Tubular-steel shaft is permanently bonded to the head of this superb tool. Perfect for the man who knows the best...and insists on getting it.

No. A16, \$575*

*Manufacturer's suggested retail price. Available throughout the United States and Canada.

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When
a man
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spent a
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engine repairs
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Buying Binoculars

(Continued from page 181)

alignment or collimation is faulty. Repeat this test, placing an object at the sides and bottom of the field.

Distortion: Straight lines should be straight. If the edge of a building or other long line appears to curve at the edge of the field, the instrument is distorting. If a line known to be smooth appears rough and of varying widths, that is distortion, too. No binocular can be perfect in this, but distortions should not be too obvious or they will prove much too bothersome to the viewer.

Sharp and Fuzzy Zones

Curvature of field: If, when focused sharply in the center, the edges of the field are slightly fuzzy, and when re-focused to get the edges sharp, the center is fuzzy, the instrument has a curved field.



SLIM DESIGN reminiscent of old-fashioned field glasses has been achieved by some German makers. Special prisms permit straight optical arrangement

That is, instead of a relatively flat plane of focus, there is a bowl-shaped sharp zone. Many low-priced instruments have this fault. If not exaggerated, it can be tolerated since most viewing is at the center of the field.

Chromatic aberration: If trees, poles or buildings against the bright sky show bright fringes of color, the lens-and-prism system is not bringing light of different colors to the same focus. Definition suffers greatly as a result.

The only one of these faults a dealer can correct—and that only to a limited extent—is collimation. Modern binoculars have front elements set in an eccentric ring. A man who knows something about it can adjust alignment enough to get by, but a professional technician with the right equipment is needed if you want a really precise job. ★★★



Got this problem? Want to avoid it next time?

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Less work, more wear.

The name is Du Pont LUCITE House Paint.



BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY

Less work . . . more wear



Piggyback Camper

(Continued from page 113)

camper are welcome in all public and private camping areas. The *Rand McNally Campground Guide* (\$2.95) lists the locations and facilities of 8000 camping areas liberally scattered throughout the United States and Canada, and none of them prohibit pickup campers. An added advantage to a pickup camper is that in an area where there are no campgrounds they can use the facilities of a trailer park for a fee, usually \$1 a night.

How Do They Handle?

A common criticism leveled against the larger cab-over campers is that they are top-heavy and difficult to handle in a strong wind.

"I understand there is a 'sucking motion' when a cab-over model passes another truck," said Carl Marcus in extolling the merits of the low-profile Alaskan.

"You'll get the same thing with a passenger car," said Bill Wiggins. "I've never found that it bothered my driving. I have my eight-foot cab-over on a short-bed Studebaker truck, and when I first used it I experienced considerable shimmy on the open highway. But I had air springs installed in the rear of the truck and this cleared it up."

The *PM* editor noted that on crowned roads he was aware of carrying a load on the back of the truck. "Any time you get off to the side," he said, "you can feel the weight of the camper tending to rock the vehicle, a sort of top-heavy feeling for a driver accustomed to a low sedan."

"There is a tendency to overdrive a truck and camper when you're used to a car," said Ken Cochrane. "But once you learn to relax and let the thing drive itself, you don't have any trouble. I was concerned about the effect of strong wind before I bought our camper, so I gave it a tough trial before making up my mind. I drove it back and forth across the Oakland (Calif.) Bay Bridge where the wind is really strong, and I didn't have a bit of trouble. I find, however, that a strong headwind will cut my gas mileage about three miles to the gallon."

Backing up and parking can be difficult for the novice and it is a wise move to have someone giving directions from outside. On the other hand, we watched an experienced owner from Michigan park a large chassis-mounted Dreamer coach into a space on a New York City street, and he did it easily and without help.

Limited visibility on the right side, a problem when entering onto a highway where there are several feeder roads,

bothered the *PM* editor. "I had to slide over to the middle of the seat to get an accurate view from the mirror on the right," he said. "And in most cases I still felt insecure about it. When my wife was in the cab she checked the right side."

Another question that comes up about pickup campers is the matter of clearance on low bridges and underpasses. "I've never heard of a problem in this respect," said a spokesman for Travel Industries, Inc. "The height of the Dreamer coaches never exceeds nine feet when mounted on the truck, and this is pretty general throughout the industry. Even a low underpass has 10 or 11 feet of clearance."

Half-ton Truck Too Small

The owners we interviewed were in total agreement that a half-ton pickup was too small to carry a camper, that the $\frac{3}{4}$ -ton truck was a minimum size for safe driving. They also agreed that heavy duty springs were a must for the rear wheels, and that the tires should be at least six-ply. Ken Cochrane also suggested split-rim wheels for the rear. In the matter of matching the size of the slide-in camper with the truck bed, it was generally agreed that 12 to 14 inches overhang beyond the tailgate should be an absolute maximum.

In the minds of many campers, a major drawback to the pickup coach is that you have to own a truck.

"It was quite a decision for us," said Carl Marcus. "We had to make up our minds that the pickup would serve as a second car for my wife to use for shopping and driving to work."

"I'll admit I had many misconceptions about pickups," said Mrs. Stephen Giles of St. Paul, Minn. "I thought it would be hard to drive, that it would be too big for me to handle. I was also concerned about what the neighbors would think. But after using one for a year I can't imagine being without it. It's easy to drive, it's comfortable, and it does so many jobs. I love it."

Pickup trucks are still workhorses, but their grooming has improved in new designs. The $\frac{3}{4}$ -ton Chevrolet truck Carl Marcus bought, for instance, is equipped with radio and heater, automatic transmission, luxurious interior, tinted windshield, heavy-duty springs and heavy-duty shock absorbers on front and rear wheels. The basic cost was slightly over \$2000, and with an additional \$600 for "extras," it was still well within the price range of the average automobile.

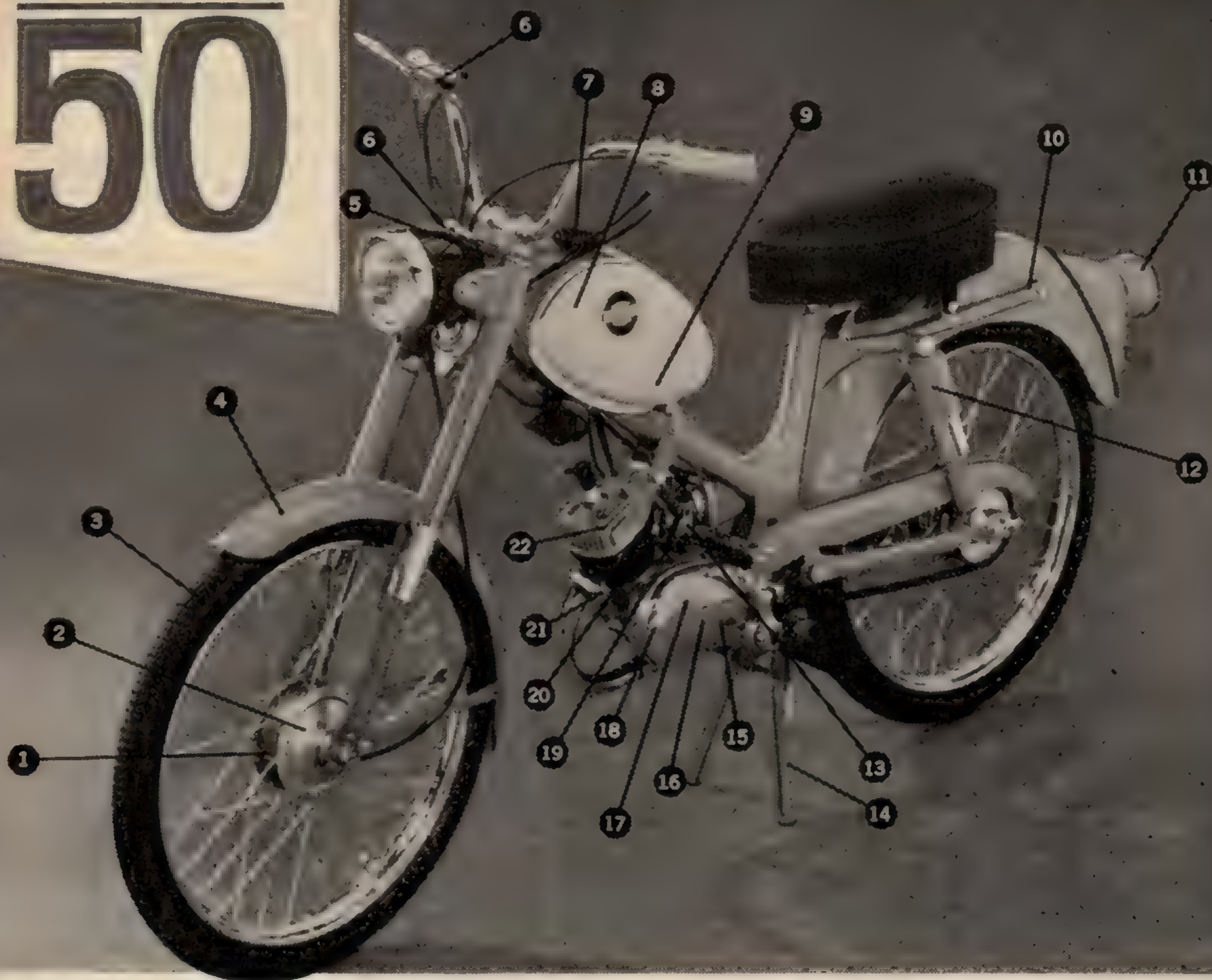
Critics of pickup campers point to the cost of the unit—disregarding the truck—in comparison to the cost of regular camping gear that can be carried in a car.

(Please turn to page 186)

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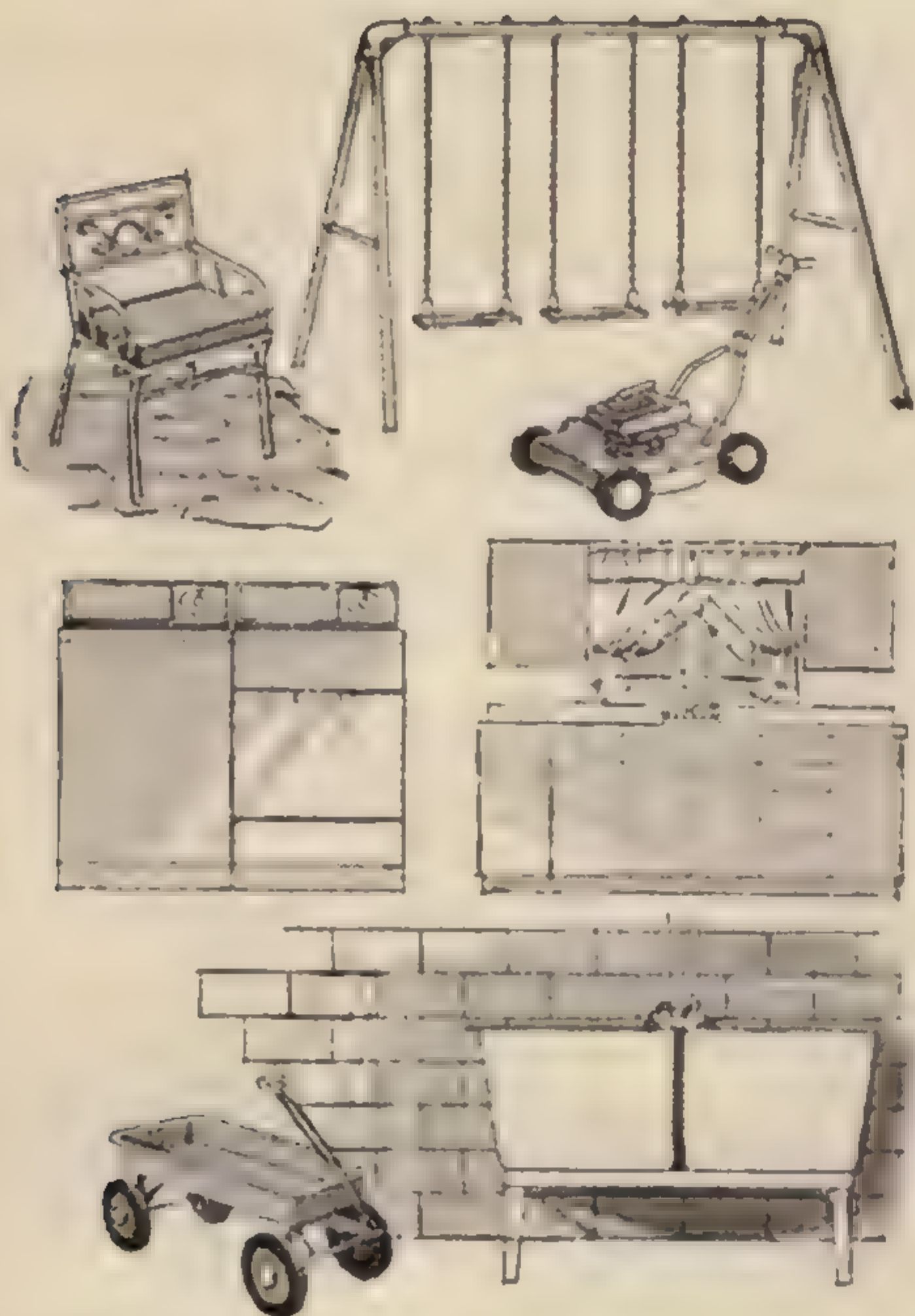
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Piggyback Camper

(Continued from page 184)

Complete camping equipment for a family of four—top quality tent, sleeping bags, air mattresses, three-burner gas stove, two gas lanterns, cooking utensils, ice chest and vacuum bottle—would run about \$350.

What They Cost

A box camper will cost about \$1000. Carl Marcus paid \$1445 for his Alaskan, while Cochrane's 10½-foot cab-over model cost \$1550. The quoted price on a 10-foot chassis-mounted model from Travel Industries, Inc., is \$1795, but with complete optional luxury equipment it would cost \$2888. With this model, which is not detachable from the truck, you would have to figure in another \$2500, raising the total package to \$5388.

"It's not a fair picture to compare a camper coach with the cost of camping gear," said Carl Marcus. "The person who owns a camper is interested in convenience and comfort. He doesn't want to be bothered with putting up a tent and taking it down, and he doesn't want to sleep on an air mattress."

"We compared the cost of a camper against the cost of a vacation trip," Ken Cochrane said, "and we decided that we would save money in the long run."

An average 14-day, 2000-mile vacation trip for a family of five, stopping at motels at from \$14 to \$16 a day, restaurant meals (\$5.50 breakfast, \$10.50 lunch, \$15 dinner), plus tips, gas and oil, would cost about \$650. If you add another \$10 a day for entertainment, it gets close to \$800.

"Over a year's time," Cochrane said, "we'll be on the road about two weekends a month. We couldn't afford it without the camper."

Before investing in a camper coach, a family can rent a unit for a weekend or a vacation. Most dealers maintain rental units, realizing that they often result in sales. An average charge is \$125 a week plus 9 cents a mile for both camper coach and truck.

It is inevitable that camper coaches should be compared with the travel trailer that is towed behind an automobile. Advocates of the travel trailer point to two advantages; there is more space even in the smallest travel trailer than in the large pickup camper, and a trailer can be quickly unhitched, freeing the automobile for side excursions.

"There's no argument about the space advantage," said Steve Giles. "But with four jacks I can have my camper off the truck in about 10 minutes. On the other

(Please turn to page 188)



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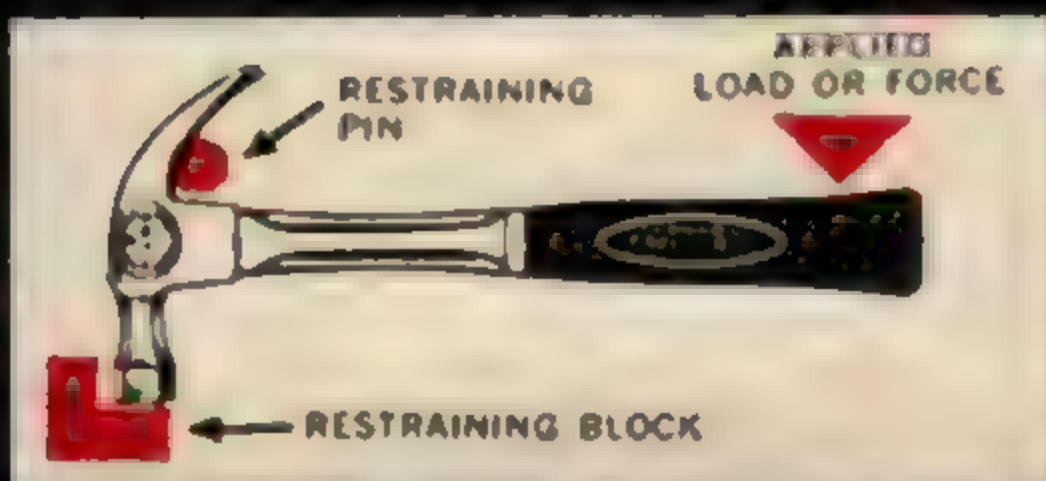
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Photograph taken in Plumb Laboratory of
Flexural Strength Test being performed on
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Diagram of test shows how
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Oldest Tools Are Copper Pins

The first straight pins that man ever invented—9000 years ago—may be the three badly corroded bits of metal unearthed near a prehistoric village at Cayonu, Turkey. Dr. Robert Braidwood of the Oriental Institute of Chicago directed the archaeologists who found the pins.

Slightly under an inch in length, the pins are fashioned from copper, making them the earliest known tools of metal rather than wood or stone.

Timer for Laser Pulses

A method has been developed whereby the duration of a laser light pulse may be varied from a few billionths to several thousandths of a second.

Laser light is highly directional and extremely bright. Its application can be found

in such wide-ranging fields as communications, welding, ranging and tracking, and medicine. Westinghouse Defense and Space Center researchers expect the new development to render the laser still more versatile.

Slot Wing for Crop Dusting

A new airplane wing, having a slot on the upper trailing edge through which fertilizer, seed or pesticide can be sprayed, may improve crop dusting techniques. A controlled blast of air, produced by a separate engine, ejects as much as 50 pounds of material per second while the plane travels at speeds up to 140 mph.

The airplane design is a result of collaboration between representatives of the University of California, Aerial Distributors, Inc., and the University of Wichita, Kansas.

Piggyback Camper

(Continued from page 186)

hand, I don't think it's necessary. The advantage of the pickup camper is that it can travel over terrain that you wouldn't attempt in a car."

"You really shouldn't be without a set of jacks," Cochrane pointed out. "I don't have them as yet, but I will in the future. If my truck should break down and have to spend a few days in a garage I'd really be stuck; the camper would have to go to the garage with it."

It is a law in all states that passengers are forbidden to ride in a trailer when it is in motion. This law does not hold true for truck campers. In most states trailers are restricted to a road speed of 45 to 50 mph, whereas a truck camper can drive at the maximum speeds for cars.

No Special Fees

On toll roads a pickup camper is charged the same rate as a passenger car. Travel trailers are generally charged an extra fee, often based on the number of axles on the trailer. There are also state registration fees for trailers (\$3 to \$10) and a special operator's license is required (50 cents to \$4 a year). The pickup camper generally requires a commercial license, but there are no extra fees, and it can be driven with a regular operator's license.

The major reason for owning a pickup camper is convenience; you have a small vacation cabin that can be taken anywhere there are car tracks.

"Take me, for example," recalled Cochrane. "I got home from work about 3:30 Friday afternoon. My wife had already replenished the food supply and put the perishables into the ice box. Anything else we might want, books, extra clothing, fishing gear, rock hammers and so forth are kept in the camper. While I was filling the water tank with the garden hose my wife was closing up the house. By four o'clock that afternoon we were pulling out of the driveway."

"When we stopped for gas we also bought enough ice for the weekend. After driving for about two hours we pulled off the road and had dinner. I drove on after dinner while the family relaxed in the coach and when I got tired I pulled into a roadside rest area and that's where we spent the night. You couldn't ask for more convenience than that."

When we asked Mrs. Cochrane what she thought about going back to regular camping, she turned from the stove where she was preparing dinner, and said with a laugh, "I've already told this to Ken. He'd have to drag me into a tent." ★★★

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Gold Mining Bonanza

(Continued from page 105)

the wire mesh catches the flour gold.

Opening an eight-ounce jar that was half filled with gold nuggets (the result of two months' work for three men), Graham removed one nugget the size of a large bean. "This is a good collector piece and should bring at least \$100," he said. Although the government price for gold is \$35 an ounce, nuggets are usually sold to collectors for much higher prices.

"This is what we get from the sluice box," he said, indicating a dozen quart jars filled with black sand. "This is a form of iron pyrite, and wherever you find black sands like this you're going to find some gold. We could pan the flour gold out of this, but we save time by taking it down to Placerville and have it run through a centrifugal-force machine."

The weekend diving prospector generally uses a smaller underwater dredge. It costs less than the larger surface dredge (about \$159) and does essentially the same job in shallow water. The vacuum head is attached directly to a sluice that is about four feet long, is narrow at the mouth and flares out slightly at the far end. A riffle box (a small, detachable box fitted with baffles) near the end of the sluice collects the black sand and gold.

Using a crowbar, the diver moves boulders, opens cracks and fissures, and vacuums up the hidden deposits of sand, gravel—and possibly gold.

Sniping for Gold

Dredging is the most efficient method of prospecting the streams, but the method used by the majority of families who have turned gold-seeking into a sport is called "sniping."

A sniper's equipment consists of a pick and shovel, a gold pan, a knife or pointed digging tool, a large spoon, a pair of tweezers, small glass bottle and magnet.

When spring floods turn the rivers and streams into a turmoil the placer deposits are stirred and shifted and transported downstream. A considerable amount of gold is moved and the lighter flakes are deposited into rock crevices along the river bank and covered with sand and gravel.

Digging away the loose top soil with pick and shovel, the sniper gets down to the rock. When he gets close to bedrock, he cleans out the crevices with the digging tool, using the spoon to fill his pan about two-thirds full. Roots and moss are included in this "paydirt," since they will often hold small flakes of gold.

The pan of dirt is then placed at the bottom of a shallow part of the stream

where there is sufficient current to carry away loose material, but not so strong that it would empty the pan. Holding the pan with one hand, the sniper washes his load with his free hand. Rocks, pebbles, roots and moss are carefully washed over the pan and discarded. Lumps are broken up. The material is thoroughly mixed and stirred until the dirt has been floated off and only sand and gravel remains.

The next step, "sloughing off," is done by lifting the pan out of the water while it is tilted slightly forward, letting the lighter materials spill off the front.

Actual panning begins when only sand and gravel remain in the pan. Holding the pan in both hands, tilted slightly forward, with just enough water to cover the material, the sniper works the pan back and forth, turning it at the same time in a clockwise and counter-clockwise movement. This is kept up until only black sand remains. Using his magnet, he removes the black sand, searching it for flakes of gold, which he removes with the tweezers and places in the glass bottle.

"It's that first color that hooks you," said the school teacher from Monterey. "At first you can't believe it's gold. You hold it to the light. Pyrite will change color at different angles, but real gold always has the same metallic lustre. Then you squeeze it hard with the tweezer. Pyrites or biotite mica, which look like gold, will shatter. But sure enough, it's malleable. Gold! It's a real thrill, and it's even more of a thrill for the kids. Makes them feel like real sourdoughs."

Practically untapped hunting grounds for the amateur prospector are the arid regions such as Arizona or New Mexico where ancient streams have dried up, leaving placer deposits under the sand. The lack of water has kept panners away, but there is now a device for dry panning.

The Mighty Midas is a portable gold concentrator. A funnel drops the "pay dirt" onto a small table through which a steady stream of air is forced by a compressor (see photo, top of page 104).

Gold panners will find placer deposits in 28 states (see map, page 104). The U.S. Dept. of the Interior, Washington, D.C. 20240, offers detailed maps showing placer deposits that have produced over 10,000 ounces of gold, and the PM Service Bureau will send, on request, a list of U.S. counties where there are known deposits.

"It is generally supposed that every mile of river in the Mother Lode still holds \$1 million in gold," said a geologist in Downieville. "Just on that basis I would say that there is plenty of gold to be found in any placer deposit in the country. You just have to work for it."—Stuart James

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Last of the Ironclads

(Continued from page 101)

sides. As water was pumped out of these barges they would rise and lift the hulk. Still submerged the *Cairo* could then be moved over a permanent berth barge resting on the river bottom and lowered onto its deck. Air forced into the barge would then refloat it along with the wreck.

With voluntary contributions of money, labor, supplies and equipment, divers were able to remove obstructions and enter the casemate. Sand and silt were pumped out and screened carefully for small articles.

Guns Came Up Loaded and Fused

Early in October, the ship's big bronze bell was lifted from the spar deck. One week later the divers were inside the magazines, bringing up heavy boxes of black powder, still potentially dangerous. With them came ammunition for the big guns: canister and grapeshot, solid and explosive shells, detonating caps and fuses. One by one the big guns were hauled up until all 13 were above water. The strong box, disappointingly empty, was also recovered.

Officials were amazed when a 30-pound Parrott rifle came up loaded with a fused, high-explosive shell, a wooden tampion still in its muzzle. Accidental firing would almost certainly have caused a catastrophic explosion. Another surprise was the discovery that high-explosive shells and black powder were stored in the same magazine, violating naval safety rules.

Among the most interesting artifacts salvaged were wooden chests with crewmen's mess plates, cups and spoons. Many bore individual names, initials or boat numbers scratched into their tinplated sides or bottoms. Men unable to write had sometimes scratched significant designs on their gear for quick identification.

By early February, 1964, salvage men had maneuvered several cables under the keel, following the plan recommended by engineers. These were attached to two barges, partially water-filled, on opposite sides of the hulk. As air replaced water pumped out of the barges, the cables became taut. An early spring rise on the Mississippi, backing up into the Yazoo, helped a lifting action so gentle that only a few surface bubbles outlined the bow.

Then it happened. An overnight rise in the Yazoo plus weight of driftwood massing against upstream sides of the barges caused the anchor cables to break. The barges came to rest far downstream.

As soon as conditions allowed, divers from the U.S. Army Corps of Engineers explored the site. They found the *Cairo*

(Please turn to page 194)

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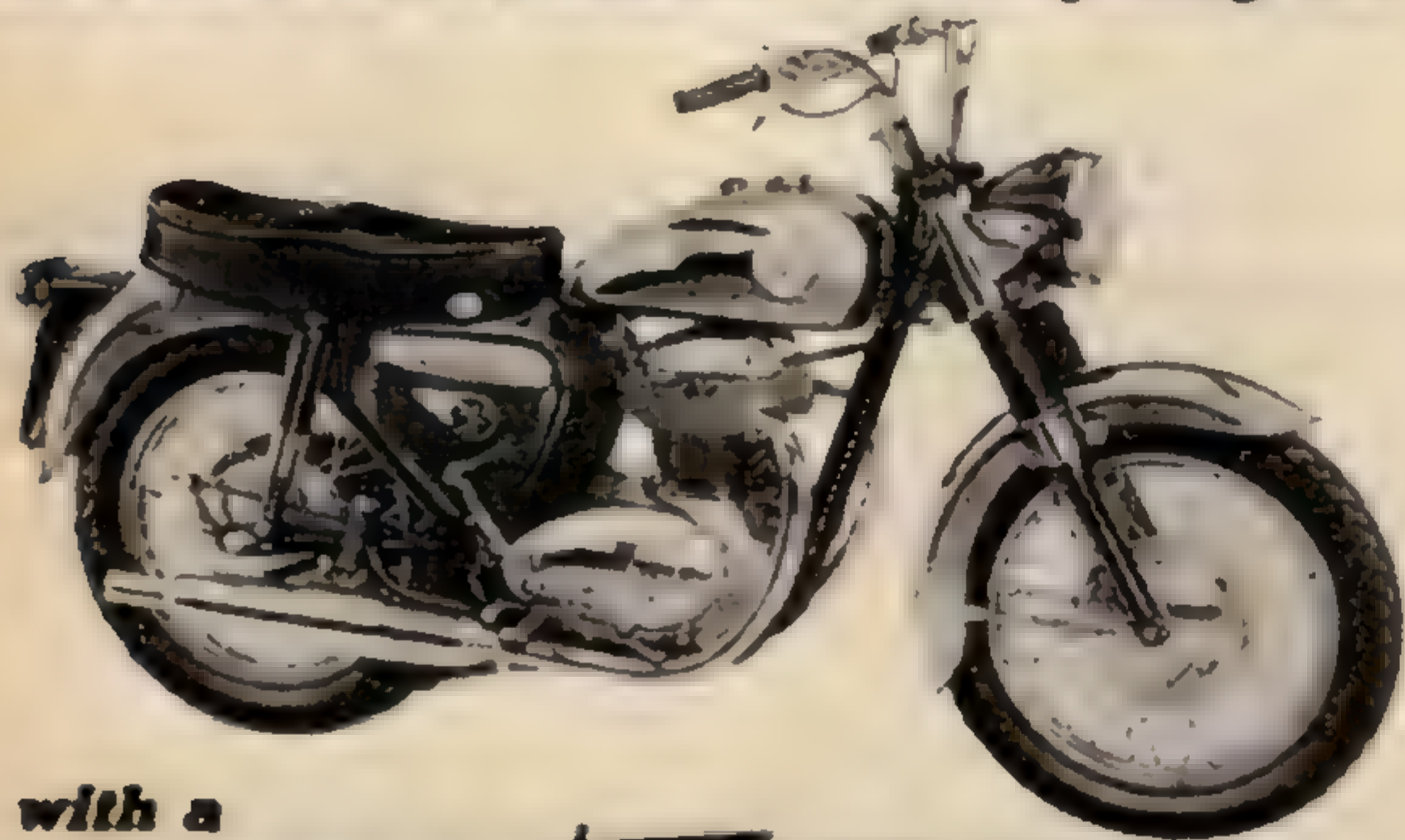
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Last of the Ironclads

(Continued from page 192)

was still at approximately the same point. Her structural soundness was further substantiated by their discovery that few planks had been torn loose. The century-old oaken timbers had remained intact.

Plainly a new method would be needed if the gunboat were to be recovered. Five months passed before a workable plan was adopted through joint action of the Vicksburg Chamber of Commerce, Warren County and the state. Following a \$50,000 authorization by the Mississippi State Legislature to finance renewed work, a salvage operator was engaged to lift the *Cairo* on cables attached to several floating cranes.

Lift Cables Sliced the Sides

Last September, the bow surfaced briefly during a test lift, but it was eased back for more dredging along the sides and stern. In October, the ironclad was finally lifted intact from the sticky bottom of the Yazoo. Still submerged, she was moved about 75 feet upstream while the berth barge was eased into position—sunk in the same trough which had been the *Cairo's* grave for almost 102 years.

The giant cranes again moved the gunboat slowly downstream and workers held their breaths as it neared the sunken barge. Watchers on shore could see the bow and the stern paddlewheel housing. But, further lifting was necessary to put the old boat atop the barge and with each additional inch, the loss of buoyancy increased the strain.

The stern was over the barge and the bow being eased into place when a steel cable suddenly sliced deep into the wooden sides. More slings were added, but the wounds were mortal. Further collapsing of the casemate made it necessary to complete the operation in three sections. Late in December, after the volunteer workers gleaned what they could from her shattered interior, the *Cairo's* remains were floated to Vicksburg, where she will be reconstructed, using as much of her original material as possible.

With the *Cairo* out of the water, it quickly became apparent why she failed to survive the strain of lifting. Her holds were literally jammed with tons and tons of ammunition; she had been restocked only the day before the sinking. This burden, plus that of the armor, sand and silt was just too much.

The successful salvaging is a welcome addition to our country's Civil War heritage and a tribute to the volunteer efforts that made it possible. ★★★

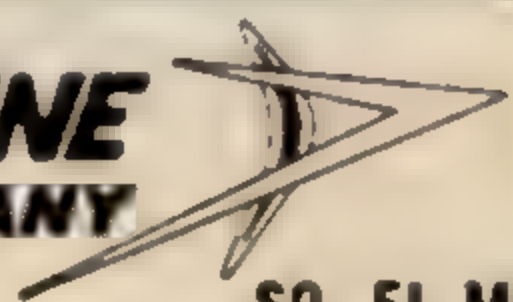
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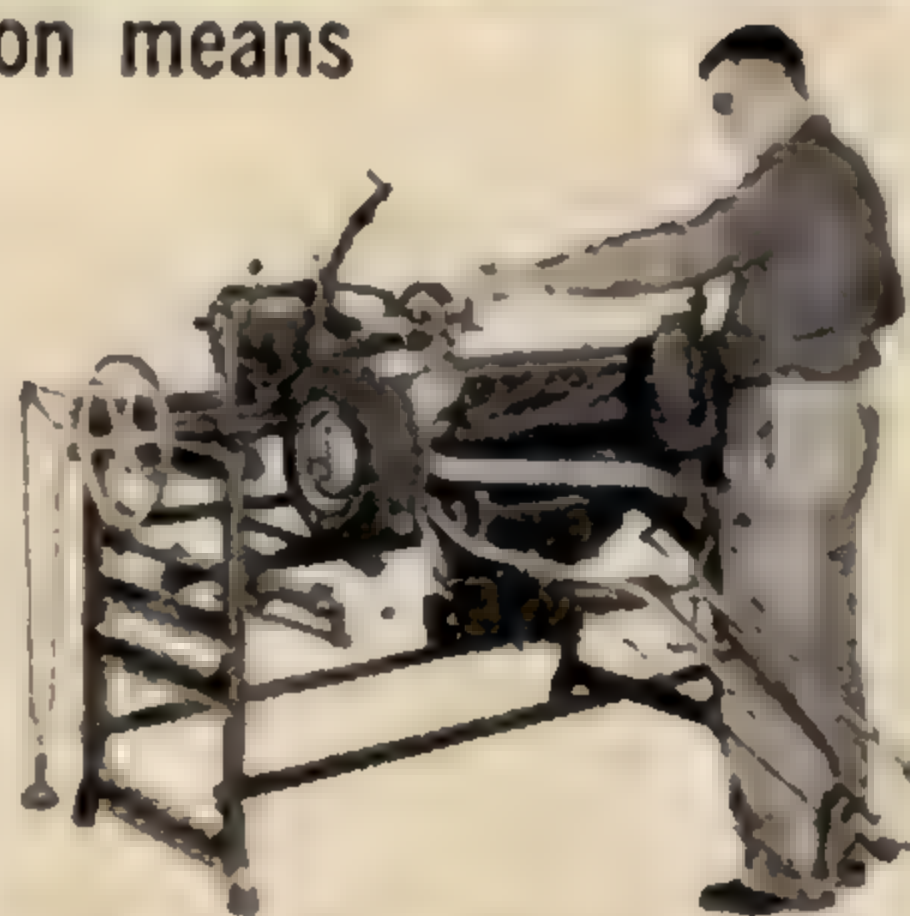
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Owners' Report—Tempest

(Continued from page 92)

automatic."—New York housewife.

"The engine is terrific, but the two-speed automatic isn't."—New Jersey student.

A two-speed trans is about as efficient as a three-legged horse.

"Poorest oil mileage I've had with a car yet."—Ohio clergyman.

"Burned 18 quarts of oil in less than 3000 miles."—North Carolina draftsman.

Better get the engine rebuilt on warranty—or buy an oil well.

Wrapping up the pluses are these five comments.

"We have four children, and the extra room is very handy."—North Carolina draftsman.

"Comfortable for at least six persons."—New York patrolman.

. . . if they're all on very friendly terms.

"The wood paneling in the dash of my GTO really sets off what I call an impressive interior."—Wisconsin technician.

"I can see all instruments very well."—Missouri mechanic.

"I like the large trunk and vinyl seats because we have a child."—Kansas engineer.

Good idea! I never thought of putting my kids in the trunk.

"Good visibility front and rear."—California TV engineer.

And now for the final five gripes.

"Gas is spilled (and paid for) every time the tank is filled."—California supervisor.

"I ran out of gas on a country road and had a terrible time trying to refill from a can."—Ohio pharmacy clerk.

We had a terrible time even finding the filler.

"Ignition switch should be to the right of the steering wheel."—Michigan teacher.

"Grille is easily dented."—Pennsylvania salesman.

It's made from reconditioned gum wrappers.

"Paint job isn't too good; there are little spots without paint."—Ohio machinist.

Our test car's paint was smooth as a baby's backside.

"With 140 hp, car is grossly underpowered."—Ohio assistant manager.

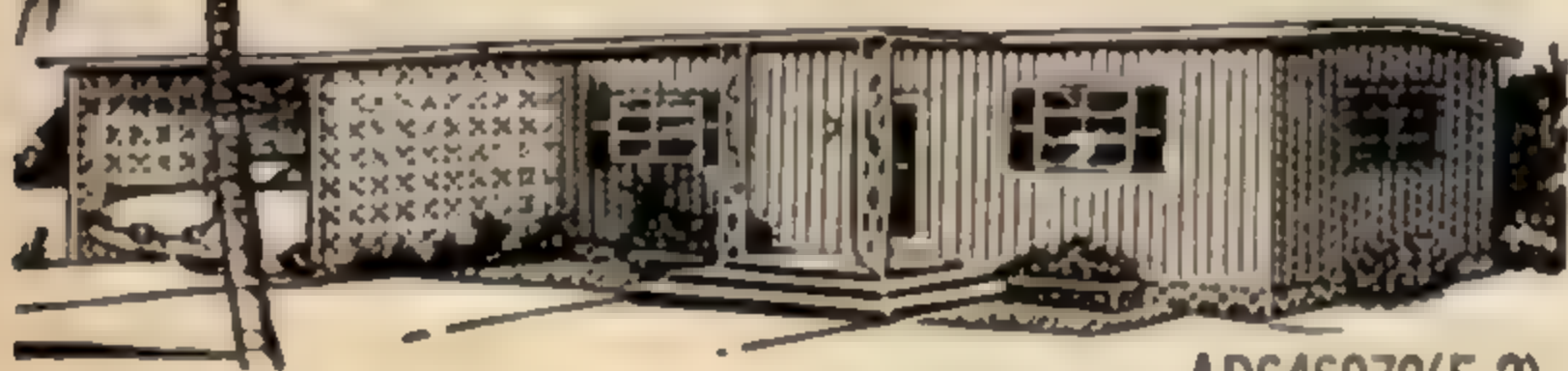
"Fades by 10-15 mph on small hills."—Connecticut salesman.

Almost all complaints about lack of power came from owners of Sixes.

And this wraps up the comments from Tempest owners, whose qualifications for test duty include a total of 812,305 miles.



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Nupercainal quickly puts raw nerve
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Missiles Over Our Heads

(Continued from page 85)

stops the spin of the missile. It is then ready for the exacting job of aiming.

During these early stages of the flight, radar at Green River has tracked *Athena* upwards. The information has been fed by leased telephone line and microwave into the central brain, a computer located at White Sands. From the computations of this electronic wizard, transferred to display panels, range-safety officers at all times have an exact picture of just where the missile will land if it continues on course—or where its fragments will land if it is destroyed aloft.

In addition, this computer is relaying information to other high-power radar sets at White Sands so that they will be pointed at the precise angle to “acquire” the *Athena* as it rises over the distant horizon.

Now, coasting at its apogee, the missile's telemetry section transmits its exact attitude, revealed by intricate sensing equipment aboard. The White Sands computer, combining this information with that furnished by the radar sets, calculates the exact angle at which the payload must be aimed in order to bring it onto the impact target. To be most effective, the nose cone must land midway between two radar installations 90 miles apart.

The computer's commands go out via telemetry to the *Athena*'s control system of gyros and gas jets. The missile pitches over and stops, adjusting momentarily so that it is sighted as accurately as any tournament-fired rifle.

Spin-Up Completed

Firing of the third stage is delayed until precise aim is assured and checked. The computer locates the exact impact point and decides whether this is a fire or no-fire situation. If everything looks right, the missile is re-spun by small jets, this time to five revolutions per second.

When spin-up has been completed, the attitude controller and the telemetry package are ejected and coast on into the desert at White Sands. The payload, however, is thrust downward toward its target by the third and fourth stage motors, generating 8000 and 5000 pounds thrust respectively. These are ignited at the proper instant, again on command from the busy computer. Between these last stages the missile is again de-spun and re-spun. If no commands are available from the ground, *Athena* goes through all this via a pre-planned timing system.

Retro-rockets now separate the burned-out last stage from the payload, which by

this time is approaching a speed of $4\frac{1}{2}$ miles per second. As this intricate, secret payload enters the atmosphere its flaming characteristics can be studied by optical and electronic systems focused upon it. This is the payoff, the purpose for the whole elaborate machinery of the new range. That 50 pounds of instrumentation comes down into the earth's envelope at a desired angle, precisely on prescribed course and velocity.

Connie Traps 'Em

At the time of re-entry, a four-engine *Super-Constellation* flies parallel to the missile's course some 60 miles north of White Sands at about 20,000 feet. It is appropriately named TRAP (terminal radiation program) aircraft. Mounted in this airborne laboratory is a battery of infrared and ultraviolet cameras, which televise their pictures to crews below. As the missile begins its fiery course to destruction, automatic tracking devices aim the turrets in which these cameras and instruments are mounted. Tapes of all their readings, as well as the telemetry describing the life of the rocket, are made. Thus a complete record of re-entry phenomena is obtained. Later it can be compared to actual ICBM data so that a usable scale may be constructed. Using this information and scale, experts can arrive at accurate estimates of ICBM behavior.

At White Sands, four large radar sets at two sites complete the mission of the inland range. All these instruments can be steered by the computer independently. As the missile arrives, the electrical characteristics of its entry are observed by the radars, capable of operating at anywhere from 100 to 3000 megacycles. Oscilloscope photography records the data which is particularly susceptible to this method.

Obviously, this is anything but a haphazard affair. Anyone who has the chance to watch may feel a peculiar pride that he is contributing to such advanced technology. The intricacy and accuracy of the range's operation is encouraging proof of our competence in a crucial field.

Perhaps more important to a citizen whose own home may someday be overflown by similar test missiles is the picture provided to range officers of the *Athena*'s flight and possible impact points. During the very first launch last year (1964), the sudden opportunity arose to make use of such emergency information.

Some stages of a missile refused to separate at the proper altitude. The whole package veered off course to the east without warning. Instant destruction of the vagrant *Athena* certainly seemed advis-

(Please turn to page 200)



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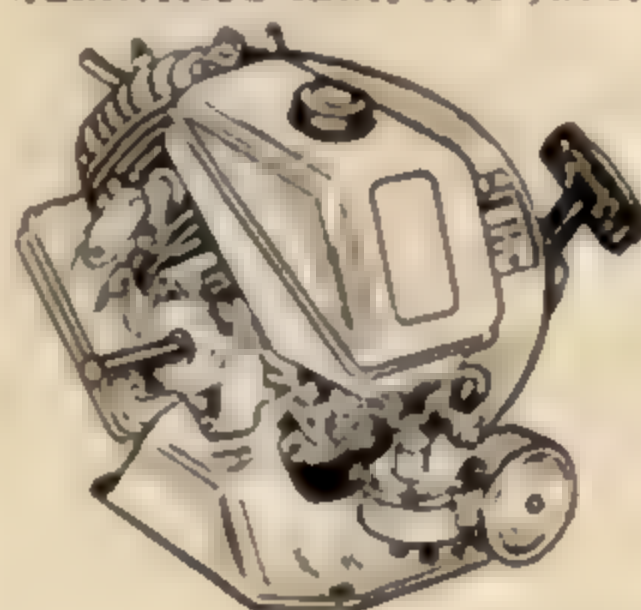
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Special (item 1002)

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2 for \$58.50
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5 3/4 hp.

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Southern Customers write Dept. A665, Box 65, Sarasota, Florida

Missiles Over Our Heads

(Continued from page 198)

able. But the computer showed that its fragments might scatter over a populated area to the south.

So the remaining stages were allowed to continue intact, ignition of their propellant was denied and the package crashed in a deserted area of southern Colorado without harm.

Residents of the nearby Durango region were understandably disturbed at first, but later were relieved when shown exactly why the safety officer's choice was the right one. Two other *Athena* missiles have been destroyed shortly after launch and the fragments landed as planned on the Utah safety zone. In all cases, immediate recovery of the missiles' remains helped show what went wrong and what improvements were necessary—something which would have been impossible at sea.

All told, 77 launches were originally planned for an 18-month firing period, which has now been extended. As the program is stepped up, perhaps two missiles will be fired at each of the twice-weekly sessions.

The *Athena* shots are part of a temporary program. Later, the fate of the range

itself will become known. There is evidence that its extension to the north might be useful for testing even longer-range ground-to-ground missiles. From the results obtained now will come the answer to the obvious questions of safety which would be involved. Meanwhile, our first real inland range is providing answers to an even greater problem—the safety of the nation. ★★★



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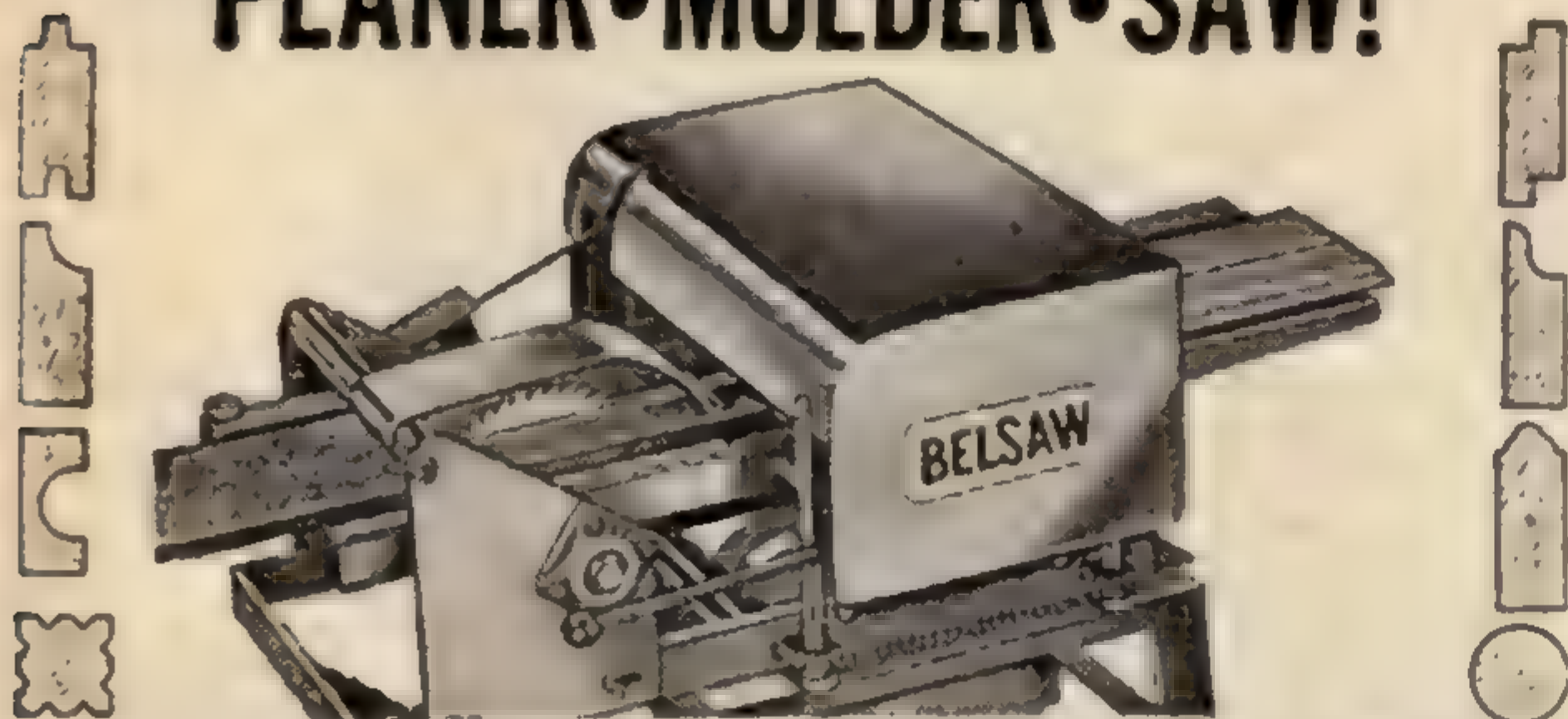
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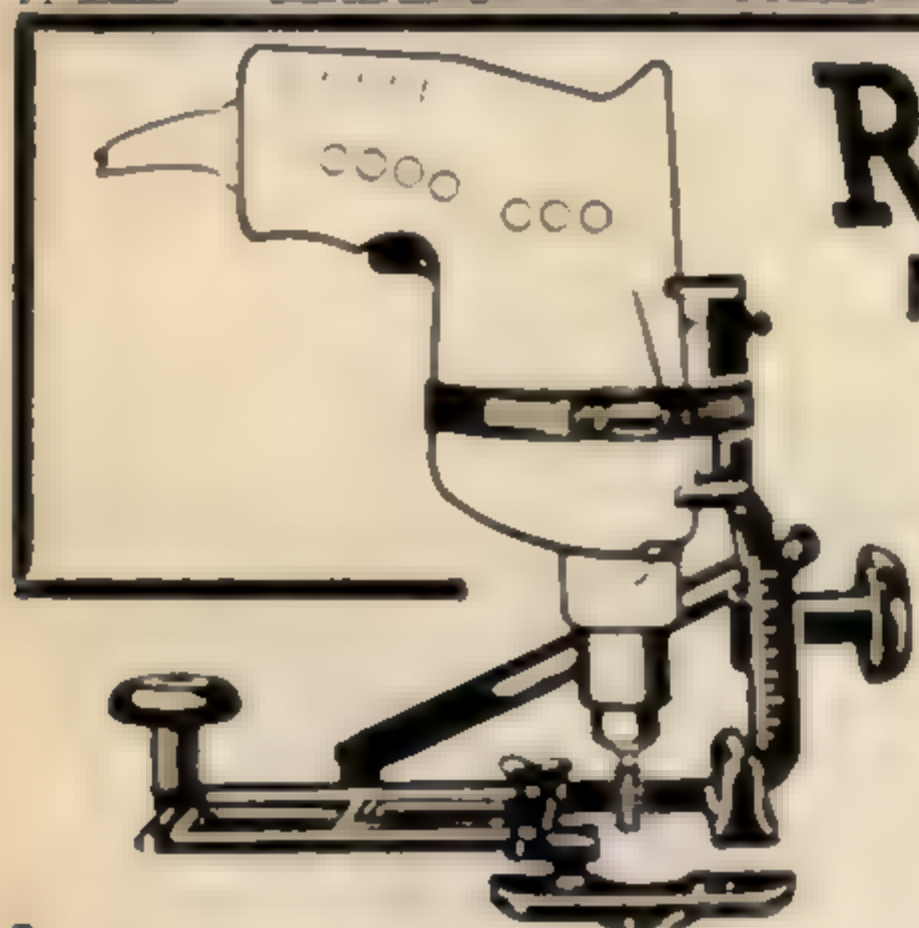
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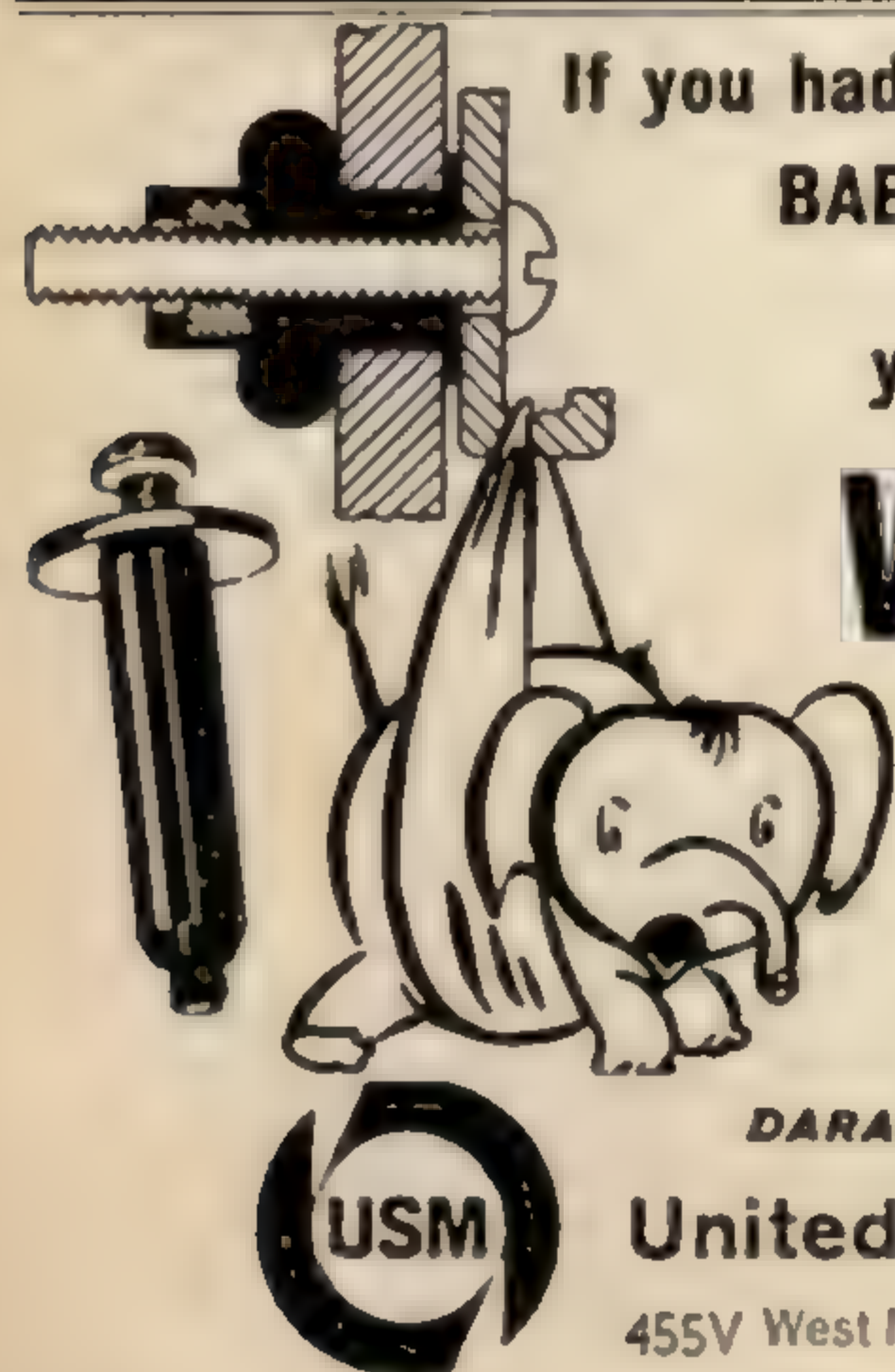
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Drive It Cool

(Continued from page 81)

if you skip the conditioner, the extra-capacity components will pay off in longer life and better, more dependable performance.

Even if it's too late to change such basics as your axle ratio, common-sense behavior behind the wheel can help ease the cooler's job. Use your foot as a fast-idle device: Shift into Neutral and speed the engine slightly if you're stuck in traffic with the conditioner on. When climbing long grades at low speeds, use a lower gear to keep engine speed up.

Although it may be less attractive than tinted glass, tinted plastic sheet will give a similar effect to the rear window and windshield. You can choose oversize tires any time you need a new set and a heavy duty fan can be added at little cost.

Adding a cooler to your present car can be fully successful or completely disastrous. If your engine already heats up in traffic, a cooler will make it worse. A marginal electrical system can't keep the battery charged when blower load is added. If cooling restrictions cause gasoline to bubble in the lines, a weak fuel pump will have trouble moving the partly vaporized fuel. Be sure the electrical, ignition, fuel and cooling systems are in top shape.

Caution note: To Saturday mechanics considering a do-it-yourself job, the best advice is "watch yourself!" The popular approach—do the job, botch it, then read the instructions—can have serious results. For your own protection, leave the belt tension adjustment and addition of the dangerous-to-handle refrigerant to a mechanic equipped with the proper specialized tools and know-how. And let him check out your completed installation—even if you have done only a small portion of the work.

Maintenance Tips

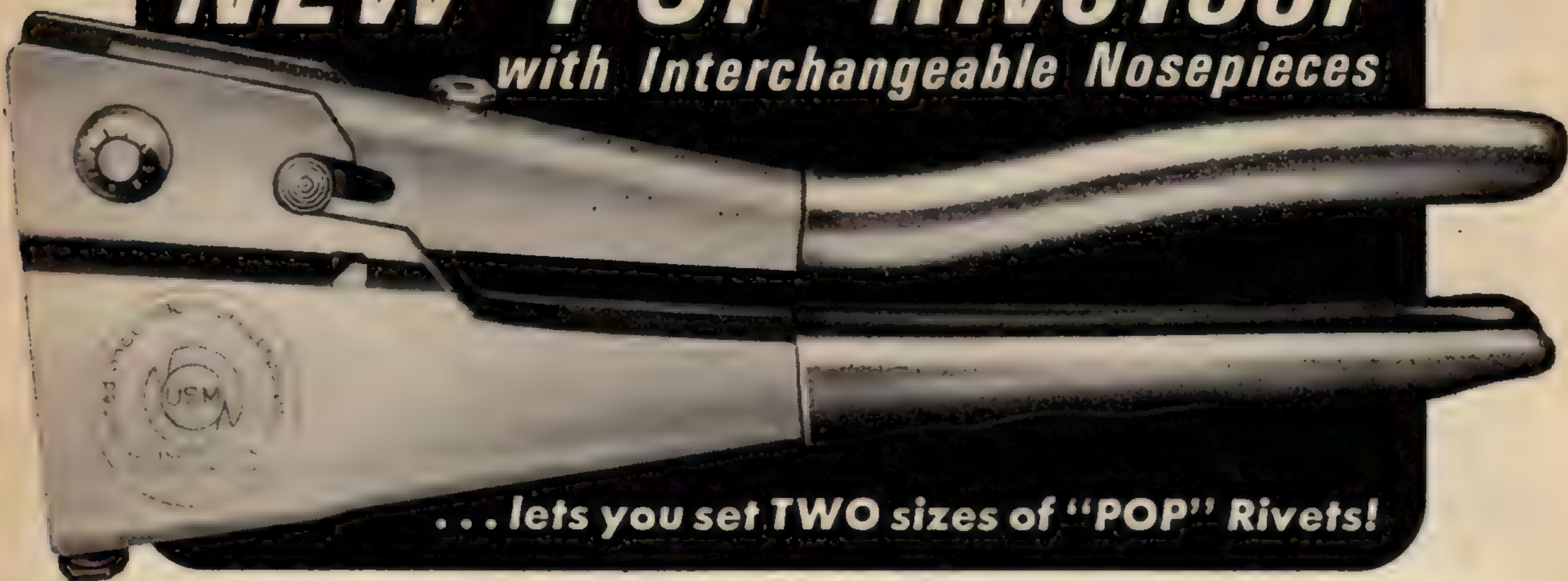
Modern units usually require little maintenance, but keep an eye on the sight glass in the receiver-dryer. Bubbles indicate you've lost some refrigerant; if you see them, turn off cooler immediately or you may ruin the compressor—hardware representing about 40 percent of air-conditioner cost.

That's the opinion of Robert Anderson, Dallas airconditioning expert who sells service contracts on all units. "Every manufacturer tells owners to run their units about 15 minutes a week all year long," Anderson told PM, "and, almost to a man, they ignore it." It's no surprise,

(Please turn to page 204)

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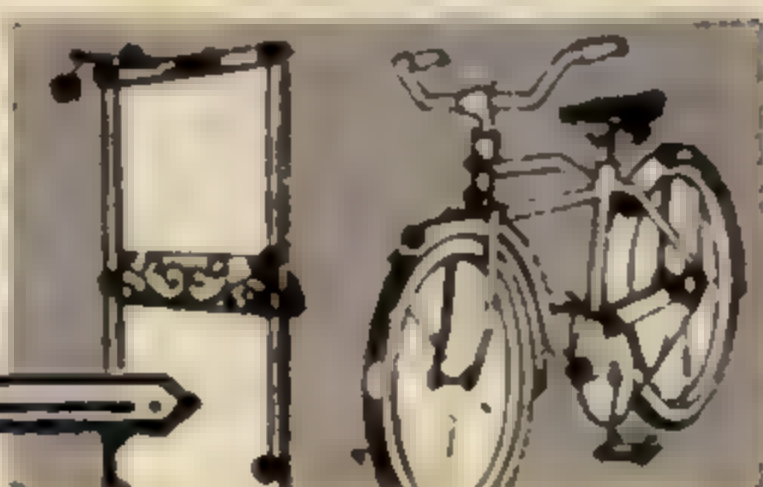
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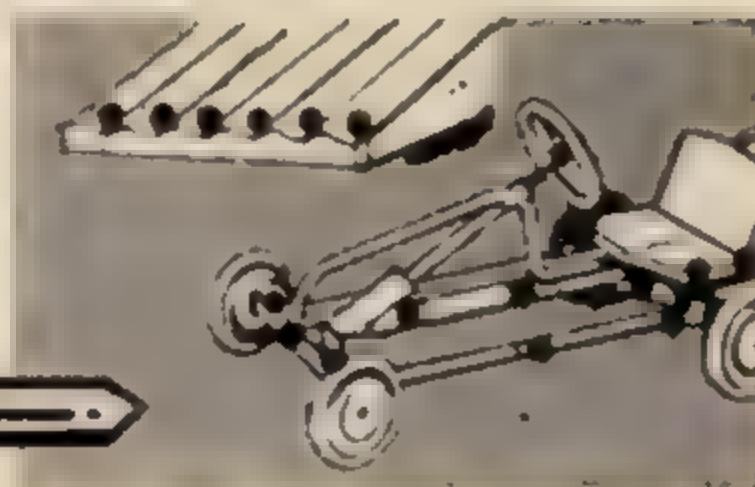


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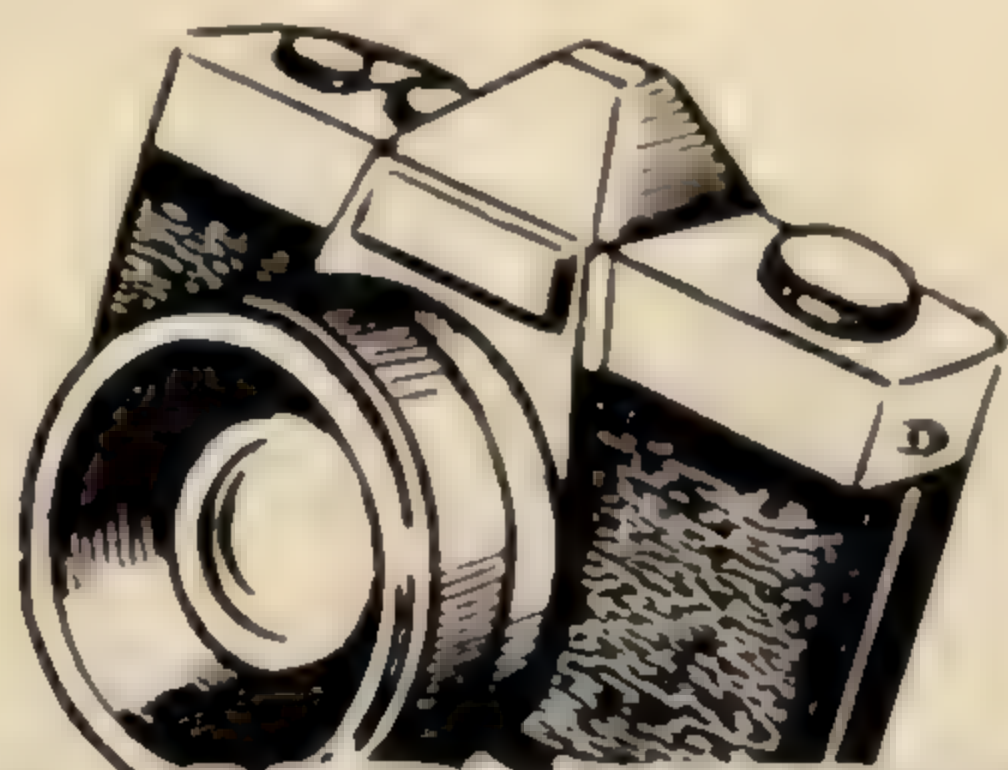
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Drive It Cool

(Continued from page 202)

then, that compressor seals dry out and refrigerant escapes.

"If you see any mysterious oil around the compressor, especially if bubbles also are visible in the receiver sight glass, shut the system off until it can be checked," Anderson warns. "At this point there's a chance you can save the compressor."

Another point: A condenser coil choked with bugs or trash can't do its full job. If your rig cools satisfactorily under such conditions, it's only because you're overworking the rest of it. Blow the condenser out with an air hose. (And while you're at it, give the radiator a good shot.)

About the only other thing you can do is keep an eye on belt tension. Just follow the manufacturer's recommendations.

When service problems mount up beyond home remedies, a little knowledge can help keep the bill within reason.

You may run into the occasional gyp artist whose cash register only rings big numbers. Instead of blasting accumulated bugs out of the coils, he'll tell you the receiver-dryer is loaded with moisture and must be replaced. Although that only costs four or five bucks, the serviceman has to break into the system. This, in turn, calls for recharging with refrigerant. And the bill goes up, up, up. You can't be bilked by such maneuvers if you depend on the sight glass color code to tell you when there's too much moisture. And if original and subsequent charging operations were done right, you should have no moisture worry until after several such cycles.

In general, today's airconditioning systems are neat, trim and as reliable as a stick transmission. Because of the efficient layout, mechanics do routine maintenance on the rest of the car without contorting like an adagio dancer. Most factory-suggested flat rates for tune-ups are the same now, car airconditioned or not.

Soon an Electric Compressor?

What does the future hold? In-the-know sources point out that flexibility is especially prized by independents. A limiting factor is the need to drive the compressor off the fan belt or associated linkage. With alternators developing fast I'll predict an electric compressor will be introduced in the next couple of seasons. Also look for bigger condenser and evaporator coils to compensate for increasing glass area.

Just a few years ago, the car buyer who laid out a few extra bills for a heater was looked on as a weakling. Yet heaters are now standard on nearly all new cars. Can airconditioning be far behind? ★★★



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Here's How I Win Drag Races

(Continued from page 76)

cause of its richness in oxygen. After refilling the tank I lay an insulated blanket over it to keep off the sun. Cool, dense fuel produces the most power.

Our last safety chore is to push the car backward 15 or 20 feet. This is because there may be small pools of nitro in the combustion chambers, more than enough to blow out the cylinder walls when the engine is fired up. Pushing the car backward expels any nitro out through the exhaust valves where it will do no harm.

My safe-and-sane safety precautions really begin long before I reach the drag strip. They start with the construction of the car itself. I build my own and I sell a few of them and no one has ever been killed driving my equipment.

My "Wynn's Jammer" or "Swamp Rat" (both names are on the body) has a racing weight of 1383 pounds, plus myself (145 pounds) and 5 pounds of fire clothing. Wheelbase is 143 inches. Three-quarters of the vehicle's weight rests on the rear wheels when standing still for best traction. The front end is merely a steering mechanism, with 2½-inch motorcycle tires on 18-inch rims. The front end has torsion bar suspension, the rear is solid. There's no transmission. Gear ratio is 3.08 to 1.

Engine Good for 50 Runs

The supercharged Dodge hemi engine won't idle at less than 3500 rpm because of its wild cam, rich fuel mixture and cold spark plugs. But I don't dare let it idle more than a few seconds at a time. The rich mixture, at idle, would foul some of the plugs and I'd lose the race before I started. That's why I keep hitting the throttle all the way to the starting line, and while I'm sitting there. With the exotic fuels I use, an engine is good for 50 or 60 runs before it finally blows apart. I carry an extra engine and a spare supercharger, with a lot of spare parts.

I'd guess there are more than 500 unlimited fuel dragsters in the United States, but most of the drivers earn little more than "food and fuel." There are 10 top drivers in this class, of whom about five earn a good living. I've been called "king of the dragsters" because I'm said to be the biggest earner in the sport. If I take top honors at an important meet I can count on earning more than \$5000. But I can't put it all in my pocket.

It costs more than \$60 in supplies every time I make a run. I get six to eight runs from a pair of slicks and they cost \$138 per pair. Fuel is around \$7 a gallon and I'll

(Please turn to page 208)

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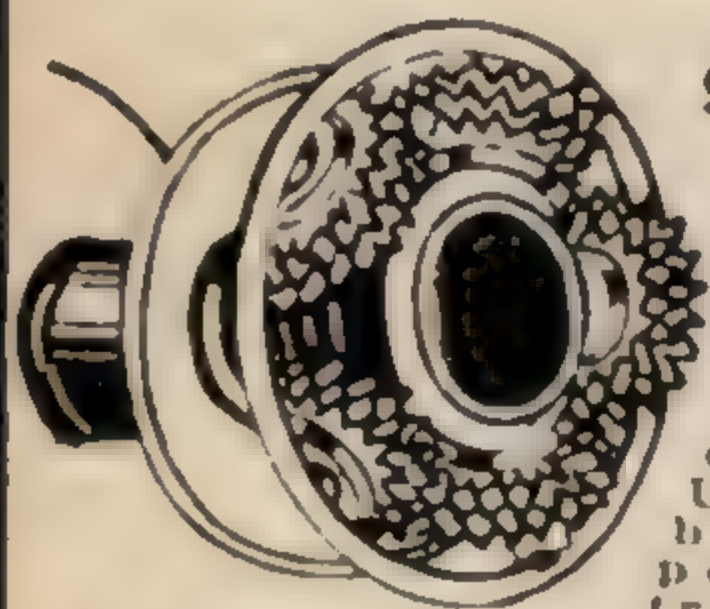
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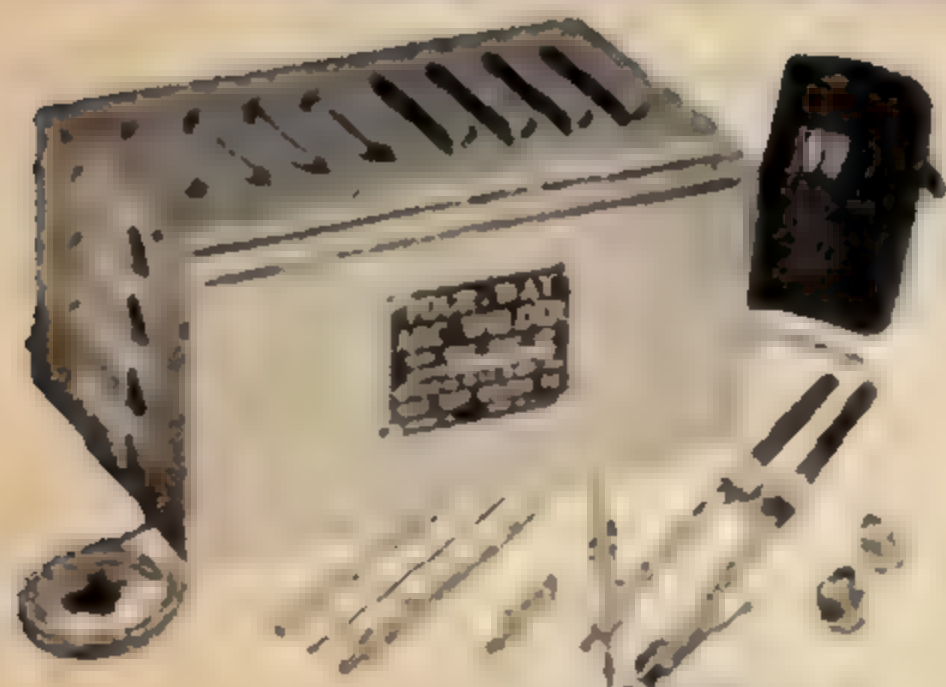
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Here's How I Win Drag Races

(Continued from page 206)

burn three gallons per run. Six quarts of oil, at a dollar a quart, are good for two runs. The eight spark plugs cost \$1.25 each and I'll use them only once for an important run. My drag chute costs \$125 and it's good for about 25 stops. That's \$5 every time I use it. And if I blow an engine it's going to cost close to \$1000 to assemble another even though I can save parts.

Drivers will be using more and more of the new Chrysler and Ford hemi engines that have just become available even though they list at more than \$1200 stripped down. They are stronger than the 10-year-old engines we've been using and it will be interesting to see which brand becomes the favorite. (That price, of course, doesn't include supercharger, injectors, the re-work or the racing parts that we install ourselves.)

Interest in acceleration contests is growing all the time; it's estimated that five million paid spectators attended almost two thousand drag programs in the United States last year. More than a quarter of a million entrants competed in the various classes, from the strictly stock cars that must not be modified aside from super-tuning, to the unlimited fuelers. It's estimated there are 325 U.S. drag strips.

The National Hot Rod Association, which sanctions and supervises about 75 percent of drag contests, has just been elected a member of the U.S. committee of the Federation Internationale de l'Automobile, the world's governing body for automotive sports. This means that NHRA now stands shoulder to shoulder with the U.S. Auto Club, National Assn. for Stock Car Auto Racing and Sports Car Club of America.

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It's the contestant who reaches the finish line first who wins the race, even though his competitor may be traveling faster at the finish. A few years ago no one dreamed it possible to accelerate to 200 mph at the end of the quarter mile. A lot of dragsters tried for it and failed.

Last year I did it twice, back to back, on the same day, and a number of other drivers have done it since then. At this writing the fastest speed attained was 206.88 mph, which I did at this year's Winternationals.

Today everyone regards 210 mph as the new speed barrier, and a lot of drivers are striving for it. I think it's going to take a new tire compound and a cool humid day for anyone to accelerate to that speed. Someone may attain it this year or next. If things work out the way I hope, I'll be that driver.

★★★

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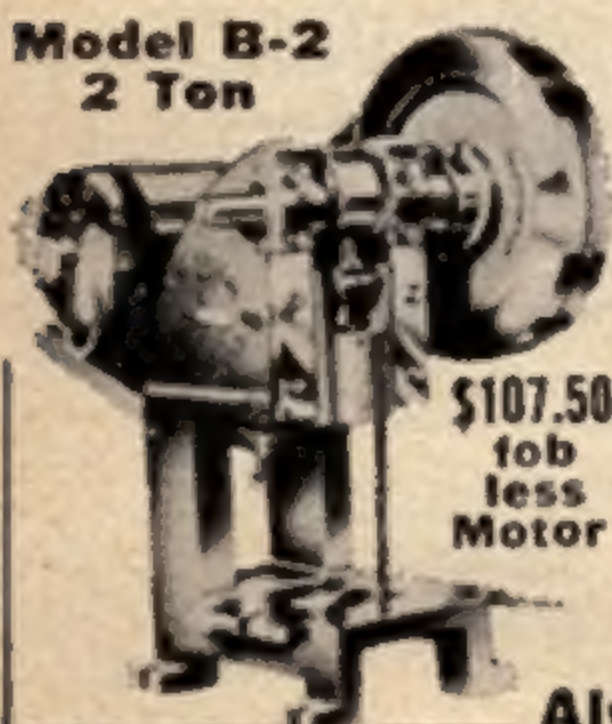
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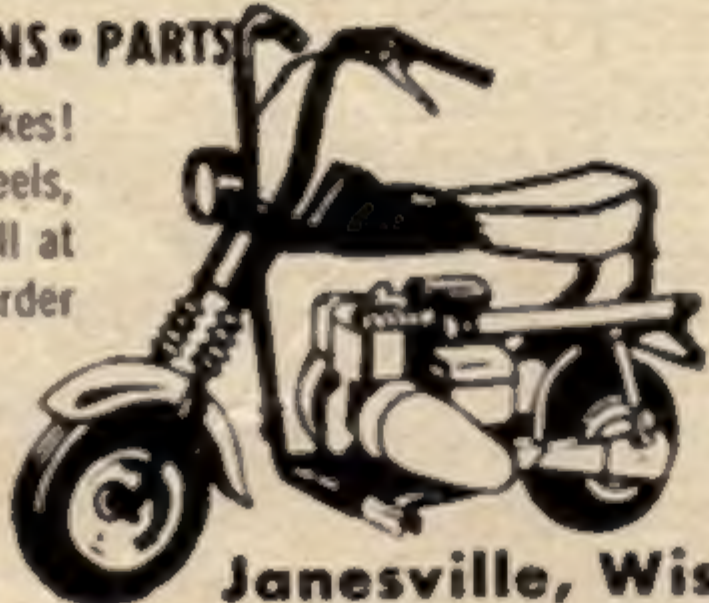
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(Continued from page 70)

motion the atmosphere and creates every aspect of the weather from soil temperature of your rose bed to the blinding blizzard that sweeps Siberia.

Basically weather is determined by the transfer of heat from the sun to the Earth, and back into space. We're still in the kindergarten stage about understanding this transfer. Dr. H. E. Landsberg, chief of the U. S. Weather Bureau's Office of Climatology, says, "We just don't know enough about the Earth's heat budget."

Five years ago it would have cost \$25,000 or more just to measure thermal radiation above one point on the Earth. Today the bureau has made such measurements at 30 scattered U.S. stations and 30 more throughout the world, thanks to radiometers. The instruments hitchhike on radiosonde balloons and measure, at 100-foot intervals, Earth-bound radiation from space and space-bound radiation from Earth. Such measurements are expected to reveal how specific radiation conditions can trigger major weather events.

Probing Weather Mystery

Other uses of radiometry may be equally spectacular. Because the instrument is so sensitive to heat, it can peer through ground haze or fog to spot incipient forest fires many miles away. It may well solve the mysterious problem of CAT—clear air turbulence—which can hurl a plane from the sky without warning. CAT is now believed to be associated with marked changes in atmospheric temperature that are invisible to a radar beam. It has been suggested that a radiometer-equipped plane could spot such CAT regions 100 miles away, giving the pilot time to plan a detour.

Because radiation determines fogging conditions, radiometers may also predict fog around airports and—just as important—the moment fog will lift.

Eventually most buildings may be equipped with radiometers to help control indoor temperatures. Today's cooling-heating systems are controlled by *inside* thermostats. Yet changes *outside*, particularly in amount of infrared radiation, determine the heating or cooling load. Radiation sensors on the exterior of buildings can provide advance warning of changes.

Radiometers are ideal for fire-alarm systems and are being installed on valuable machinery and equipment where an overheated motor could do great damage.

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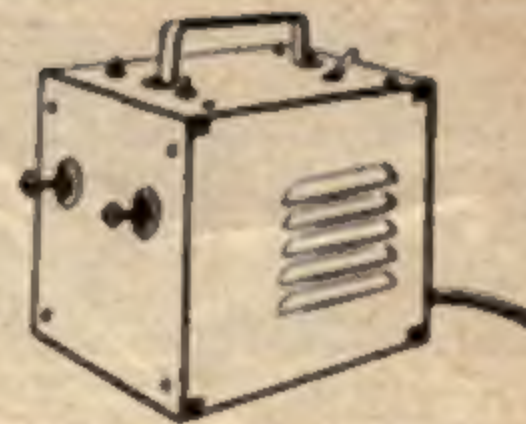
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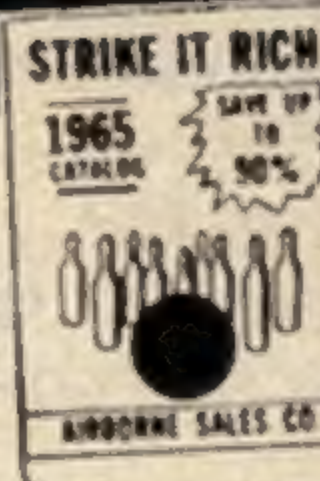


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